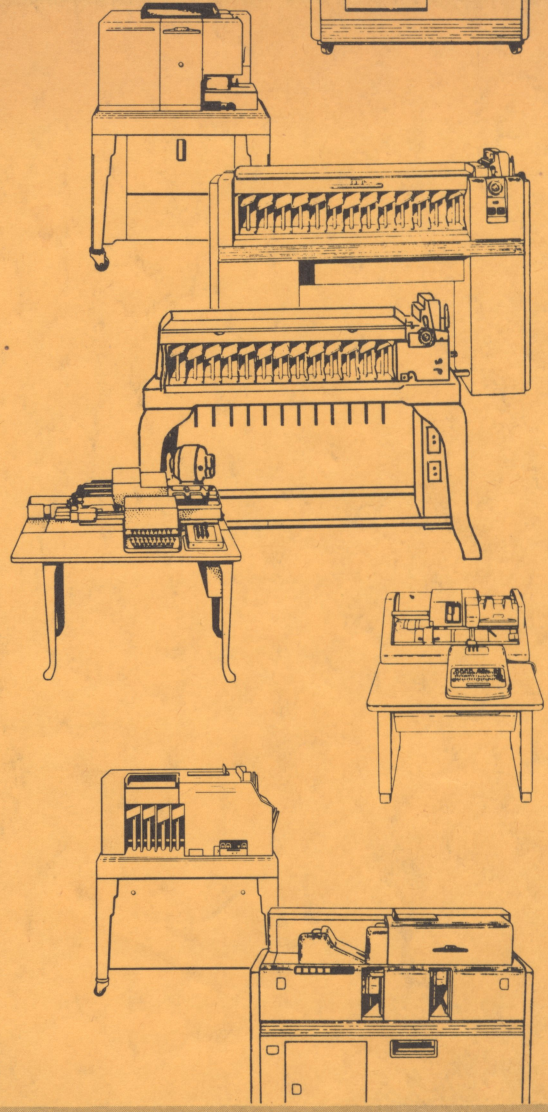
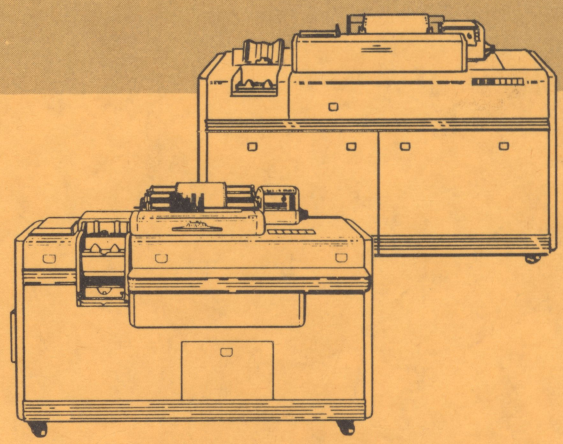
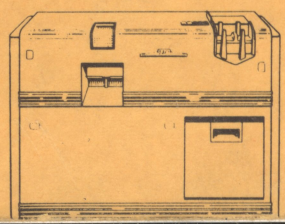


IBM

Operators Guide





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PREFACE

SKILL in the operation of any machine requires practical experience, but experience alone is not enough. A student operator can become skilled only through a combination of personal instruction, practice, and study of the written material.

The purpose of this manual is to help you to understand how several IBM Electric Accounting Machines operate and to serve as a guide during practice sessions. Study of the sections *Operating Pointers* and *How to Operate the Machine* will do much to avoid the confusion that often is the result of a trial-and-error approach.

After instruction, practice, and study of each machine, evaluate your understanding of the machine by answering the review questions without reference to the text. Once you learn to answer the questions in your own way, you will approach each machine with confidence, because you will know what you are doing and why.

Do not be discouraged if at first you cannot remember some of the terms used to describe the various features of the machines. The important thing at first is to learn where they may be found on the machine, and when and how to use them.

From a strictly operating point of view, learning how to operate IBM punched-card machines is no more difficult than learning how to drive an automobile. Even though the results obtained from each type of IBM machine vary considerably, the basic operating steps have a great deal of similarity. The basic operating steps in operating any IBM machine may be generally classified as follows:

Setup. This includes inserting the proper control panel when one is required, and setting the various switches, depending upon the machine and the specific operations to be performed.

Inserting Cards in Hopper. The hopper is that part of the machine into which IBM cards are placed by the operator, but not always in the same way. IBM machines through which only one file of cards can be processed have one hopper; machines through which two files may be processed, such as reproducers and collators, have two hoppers.

Operating Keys. The operating keys always include the *Start* and *Stop* keys, which are depressed by the operator. Several machines have additional operating keys, such as reset and total keys.

Observing Signal Lights. Most of the machines have one signal light to indicate that the machine is ready for operation. Other signal lights may be found on machines to indicate various special conditions.

Removing Cards from the Stacker. The stacker receives the cards after they pass through the machine. Reproducers have two stackers; collators have four stackers; sorters have thirteen stackers; all other machines have only one stacker. The operator removes the cards from the stackers and places them in boxes, trays, or bins for filing purposes.

Testing. Operations should be started only after a thorough test of results to be obtained has been made during a short trial run. A knowledge of the specific operations to be performed is necessary to test the setup.

This guide gives all of the information needed to operate IBM Electric Accounting Machines, except for wiring control panels, which is described in a separate set of manuals.

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IBM CARD PUNCHES

RECORDKEEPING is one of the most important tasks of any business or government agency.

Planning and handling supplies, records and services of personnel depend upon accurate and up-to-date knowledge of details, which, in turn, depend upon the compilation of reports from written records of many types. IBM electric accounting machines are used to great advantage for the preparation of these reports.

The very first operation in the whole process is the transcription of written records to punched cards. Just as punched holes in a roll of paper can produce music, so punched holes in IBM cards can produce reports. Written records can be read only by the eye, but punched-card records can be read by machines as well. Such records are sorted and summarized by machines at higher speed and with greater accuracy than would be possible by any manual process. Therefore, once the cards are punched and verified, they are the basis for all printed reports.

There are several types of IBM card punches available for transcribing written data into the form of holes punched into an IBM card. The two most commonly used are the Type 31 Alphabetical Duplicating Punch and the Type 24 Card Punch.

TYPE 31, DUPLICATING PUNCH

THIS MACHINE (Figure 1) is equipped with two keyboards, numerical and alphabetic. The numerical keyboard is used for punching numerical information,

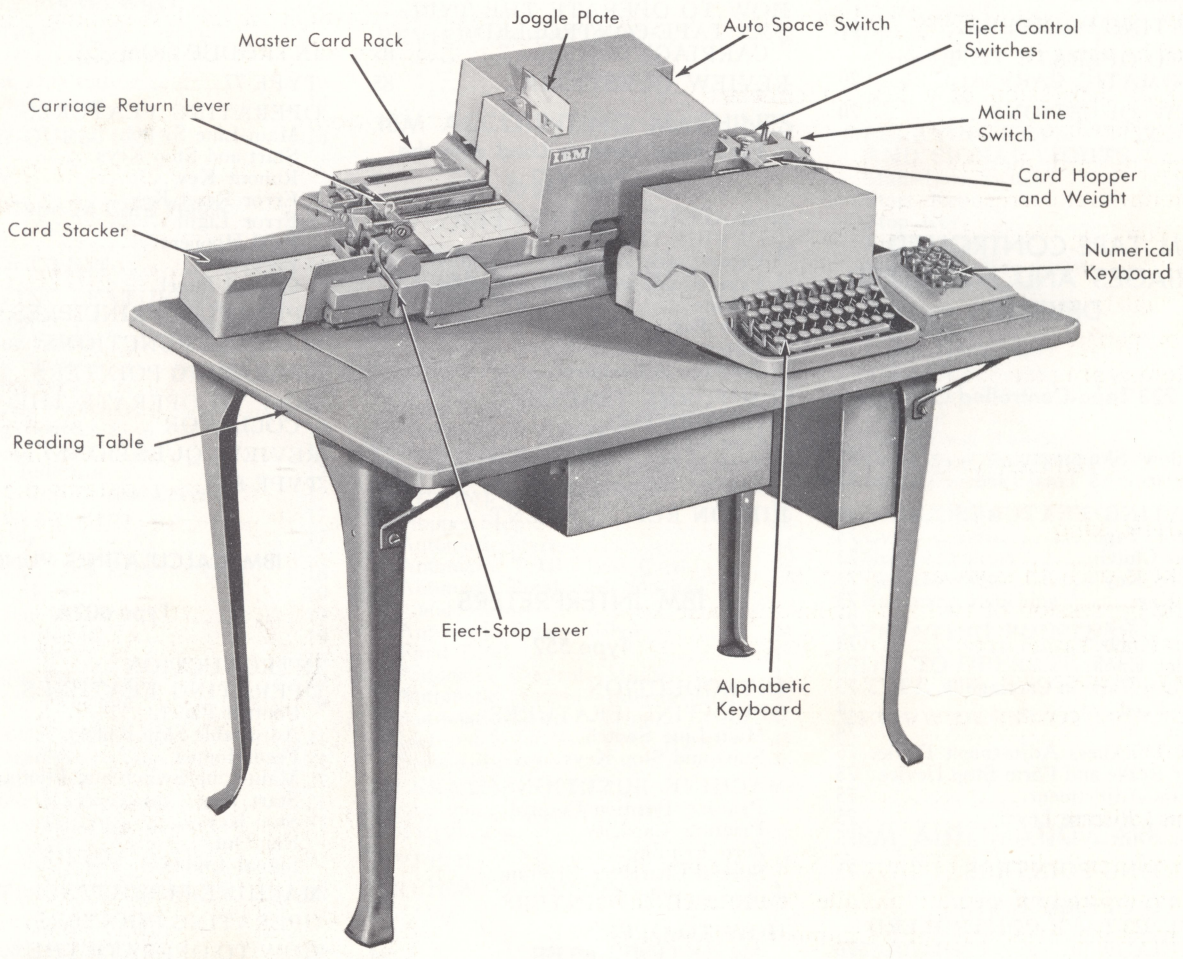


FIGURE 1. TYPE 31 DUPLICATING PUNCH

such as a serial number, item number, or other numerically coded data. The alphabetic keyboard, similar to a typewriter keyboard, is used for punching not only numerical information, but also alphabetic information, such as name or description of an item.

The two keyboards afford a means of adapting the machine to various types of punching with maximum speed and accuracy.

When alphabetic and numerical punching are interspersed, it is more practical to use the alphabetic keyboard entirely. The hands never need leave the keyboard except to turn over original documents with the left hand. However, in recording several consecutive numerical items, an operator should shift her right hand from the alphabetic to the numerical keyboard as the need arises. This applies even to experienced typists who may prefer to ignore the numerical keyboard. The numerical keyboard is simple and compact, and greater speed and proficiency can be attained by using it.

A light depression of a key on either keyboard causes a punch or punches to be electrically driven through the card, thereby cutting one or two holes in the column that corresponds to the key depressed. As each column is punched, the card is advanced automatically to the next column. This is similar to the action that takes place on a typewriter as letters are typed on paper. As the card moves from right to left the columns are punched from left to right.

OPERATING FEATURES

Key Interlocking

All keys on both keyboards are interlocked to prevent the depression of two keys from the same keyboard at the same time. However, in special cases, this key interlocking may be made permanently inoperative for certain keys commonly used in combination.

Column Indicator

The column indicator (Figure 2) is a plate bar, located immediately above and parallel to the card bed of the machine, consisting of 80 numbered divisions, each of which represents a single column of the card. The numbers are scaled from right to left, from column 1 to column 80. As the cards are being punched, the indicator pointer moves along the bar and indicates at all times the column of the card about to be punched. For example, if the last column punched is 32, the indicator will point to column 33.

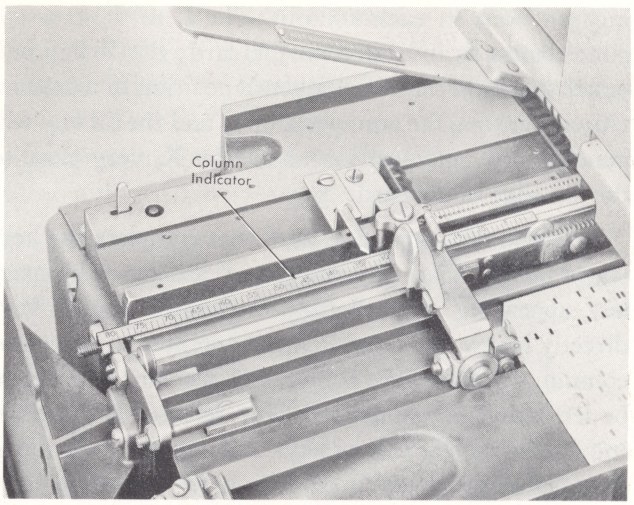


FIGURE 2. COLUMN INDICATOR

Numerical Keyboard

The numerical keyboard (Figure 3) consists of fourteen keys: the digits 0 to 9, an *X* or *11* key, a *12* key, a *Space* key, and a *Release* key.

The keys are arranged in three parallel rows for ease in the touch system of operation. The first vertical row, operated by the index finger of the right hand, contains the 12, 1, 4, 7, and space keys. The second vertical row, operated by the middle finger, contains the X, 2, 5, and 8 keys. The third vertical row, operated by the ring finger, contains the release, 0, 3, 6, and 9 keys. All keys except the space and release keys will punch a hole in one of the twelve punch-

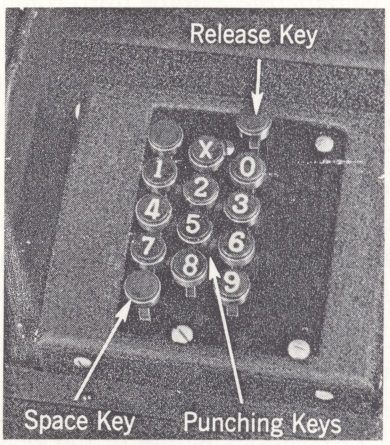


FIGURE 3. NUMERICAL KEYBOARD

ing positions in each column. The 0 to 9 keys will punch holes as indicated on the card; the X key will punch a hole in the X or eleventh position of a column (directly above the zero position); and the 12 key will punch a hole one position above the X, very close to the top edge of the card.

The two non-punching keys that complete the keyboard are the space key and the release key. The space key, appearing at the bottom of the first row of keys directly below the *7*, permits the operator to space one column at a time over columns of the card that are to be left blank or unpunched. The release key, appearing above the last row of keys and directly over the 0, releases a card from any position to a position from which it may readily be removed from the machine.

Numerical Punching

Punching numerical information is simply punching holes representing particular digits (0 to 9) in predetermined columns of the card. If, for example, a 3 and a *7* are punched in two successive columns, the number 37 is recorded for use in operations such as printing, accumulating, classifying, reproducing, filing, and multiplying, when that card is fed through one of the other machines. What this number represents is determined by the card field heading, usually shown above the zeros on the card. The term *field* is used in punched-card practice to describe a column or group of columns set aside by vertical lines for a particular item of information. Thus, the number 37 may represent year, location, warehouse, quantity, or amount. If a serial number should appear in the first 8 vertical columns of the card and read 36214901, the 3 would be punched in the first column, the 6 in the second column, the 2 in the third column, the 1 in the fourth column, and so on, as shown in Figure 4.

If the serial number to be punched in an 8-column field has only five digits, as 56074, columns 1, 2 and 3 are punched with zeros in order to keep the significant digits 5, 6, 0, *7* and 4 in their proper relation to other serial numbers. All numerical data or coded material that appears in an IBM card is punched by key depressions from either the numerical keyboard or the top row of the alphabetic keyboard.

In addition to punching digits (0 to 9) on the numerical keyboard, special indications are punched in the 11 and 12 positions by use of the keys described. It is essential that these be as accurately punched as

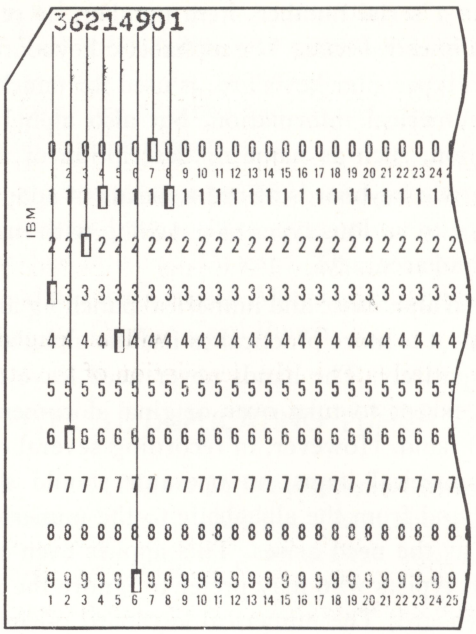


FIGURE 4. NUMERICAL PUNCHING

the numerical data, and it is highly important that punch operators become familiar with their use.

Alphabetic Keyboard

Reference to the illustration of the alphabetic keyboard (Figure 5) shows that it contains a space bar used for spacing over columns, the full range of alphabetic characters, A to Z, and the digits 2, 3, 4, 5, 6, *7*, 8, 9, 0, 1. The *1* key on the numerical or top row of

FIGURE 5. ALPHABETIC KEYBOARD

keys must be used to record digit 1. The *L* key cannot be used for a 1, because it punches two holes, 11 and 3.

The shift, tabular, backspacer, and punctuation keys are dummy keys that will neither perforate the card nor cause the machine to space. They are on the keyboard merely to simplify the use of the touch system. In addition to these keys, there are three others; SKIP to control skipping of certain fields of the card: REL and ST to control the ejection of cards already punched. These keys will be explained in greater detail later in the description of the automatic feeding and ejection of cards.

Alphabetic Punching

Alphabetic punching, that is, the recording of letters in IBM cards, is accomplished by keys on the alphabetic keyboard, which is similar in design to any standard typewriter keyboard. As previously stated, there are only twelve punching positions in each column of the card. Because there are 26 letters in the alphabet and only twelve possible positions in which to record a letter, it therefore becomes necessary to punch two holes in a column for each letter. This requires a low or numerical punch (1-9) in combination with a high or *zone* punch (0-11-12). Thus, the punching for each letter of the alphabet is as follows:

FIRST ZONE 12 punch in combination with	SECOND ZONE 11 punch in combination with	THIRD ZONE 0 punch in combination with
1-A	1-J	
2-B	2-K	2-S
3-C	3-L	3-T
4-D	4-M	4-U
5-E	5-N	5-V
6-F	6-O	6-W
7-G	7-P	7-X
8-H	8-Q	8-Y
9-I	9-R	9-Z

The two holes for any given letter of the alphabet are punched simultaneously by one depression of an alphabetic key. For example, the complete alphabet, punched with 26 key depressions in columns 25 to 50 would appear as shown in Figure 6.

It should be noted that the alphabetic X is composed of a 0 punch and a 7 punch, and it should not be confused with the X or 11 position punched by the X-key on the numerical keyboard. The former is a letter of the alphabet, while the latter is a control punch used to differentiate various classes of cards.

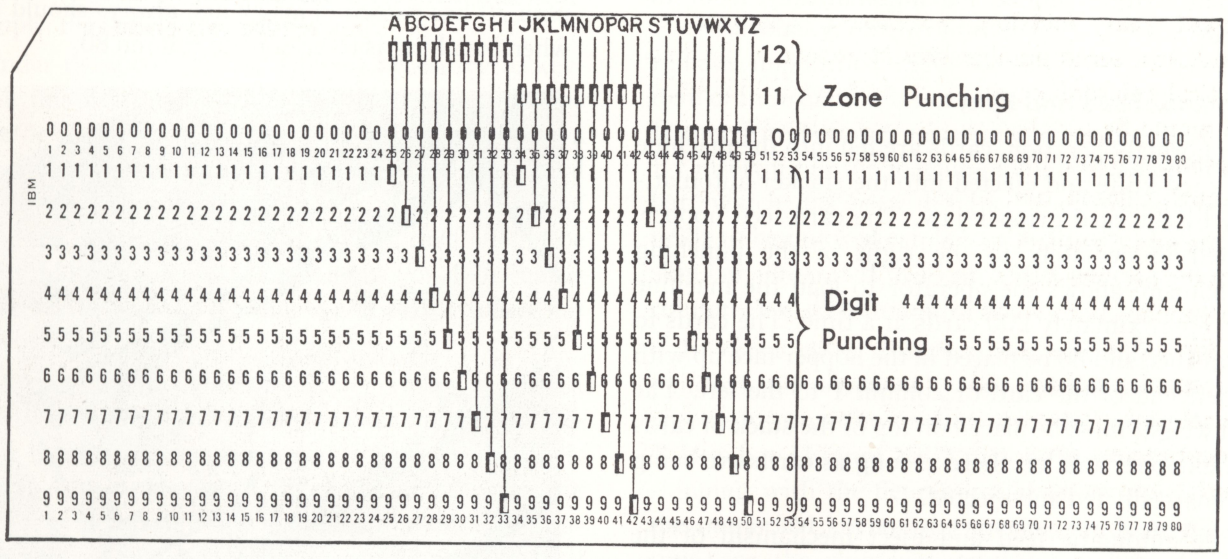


FIGURE 6. ALPHABETIC PUNCHING

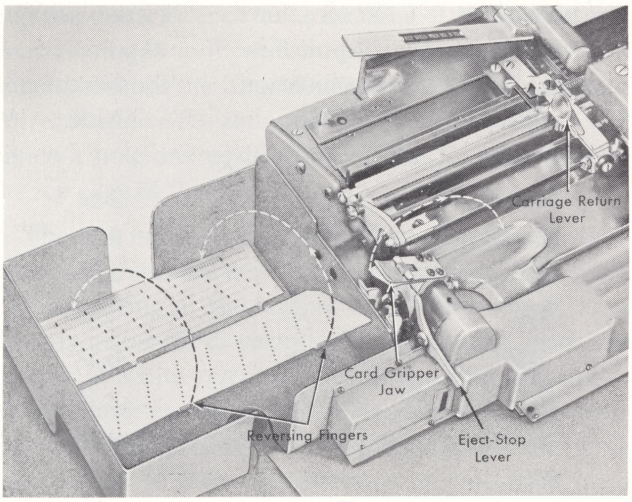


FIGURE 7. EJECT-STOP LEVER AND CARD REVERSING DEVICE

MACHINE FUNCTIONS

Hand Feed

Cards may be fed and removed from the machine by hand. In actual practice, this is rarely done except to make corrections. When it is desired to feed the cards by hand, care must be taken to see that the eject-stop lever (Figure 7) on the left side of the card bed is in its upward position, as this disengages the automatic feeding and ejecting mechanism.

It is possible to punch two cards simultaneously if desired, but both must be hand fed, because only one card at a time can be fed automatically from the hopper.

Automatic Feed and Eject

In normal operation, cards are fed into the machine by a card knife and ejected into the stacker automatically by the card gripper jaw. The card feed hopper, located immediately to the right of the punching mechanism, allows the operator to load the machine with approximately 200 cards at a time. The cards to be punched should be placed in the hopper face up with the left end of the card or column 1 to the left. The card weight must be placed on top of the stack of cards in the hopper and left there as long as cards are being automatically fed and ejected.

The automatic feed and eject mechanism of the machine operates only when the eject-stop lever is in its downward position. This allows the card gripper jaw to drop and make contact with a magnet directly underneath it, supplying the electrical impulse necessary to drive the carriage automatically to the right, while the card knife in the hopper feeds the bottom card to the left. The card is now firmly held in the carriage under the punching mechanism and is ready to be punched.

Upon the release of each card punched either automatically or by the depression of the release key, the card is gripped by the card gripper jaw, which flips it into the regular stacker face down. If the card reversing device is in use, the same card flips again face up into the auxiliary stacker directly behind the regular stacker, thus reversing the sequence of the cards. Another card is then automatically fed from the hopper into punching position.

The use of the automatic feed mechanism eliminates all unnecessary movement of the hands and makes it possible for the operator to concentrate on punching. Fatigue is reduced to a minimum with a resultant increase in both accuracy and speed.

Ejection Control Switches

While the automatic feeding and ejecting of cards is controlled by the eject-stop lever, the automatic flipping of cards is controlled by two switches located on a panel directly above the hopper. The upper switch is marked *Release-Key-Eject.* The lower switch is marked *Automatic Eject* (Figure 8).

When release-key-eject switch is on (with the automatic-eject switch off), the card is ejected after column 79 has passed. This switch always should be off when punching is to be done in column 80.

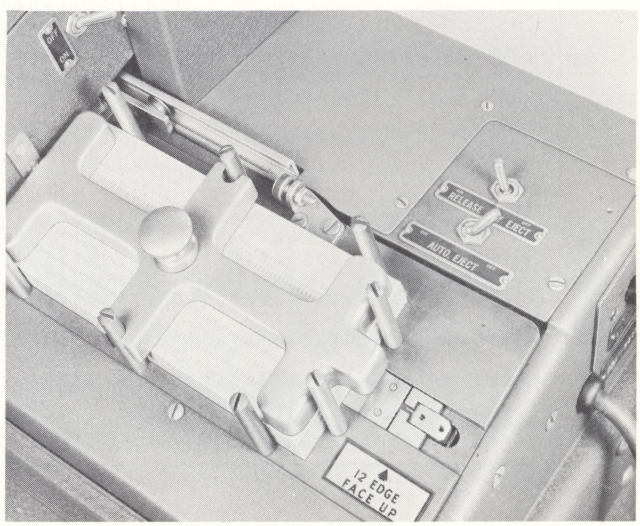


FIGURE 8. HOPPER AND EJECT CONTROL SWITCHES

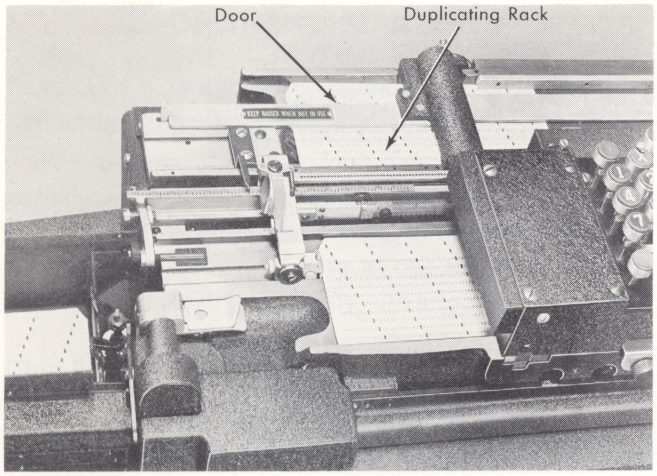


FIGURE 9. DUPLICATING RACK

The automatic-eject switch should be on (and the release-key-eject switch off), when column 80 is to be punched and ejection is to follow immediately thereafter. When both switches are off, automatic ejection becomes inoperative, permitting multiple punching in column 80. Ejection must be accomplished from column 80 by depressing the space key on the numerical keyboard or the ST (stacker) key on the alphabetic keyboard.

Duplicating Rack

One of the most important features of this punch is the duplicating rack (Figure 9), which makes it possible to transcribe automatically into a group of cards information that is to be the same on all cards, as for example, the date of the records.

Under these conditions, it is not necessary to keypunch this information into each card by hand. The operator may punch the common information into a master card, which must be placed in the master card rack of the machine, located above and to the left of the punching mechanism. The master card should be locked into position by closing the bar or door that is marked with a plate reading *Keep raised when not in use.*

Locking this bar automatically raises a set of brushes into position. As the master card feeds between the brushes and a metal roller, the brushes, lying directly underneath the punched holes in the column, pass through and contact the roller. The impulses thus set up actuate corresponding punches, and information from the master card is punched into the blank card.

This duplicating is column for column. For example, if a 3 were punched in column 1 of the master card, the same hole would be duplicated in the same column of the blank card. Alphabetic punching in the master card automatically duplicates the two holes representing a given letter.

Another use for the duplicating feature is to make over slightly damaged or incorrect cards. The card to be repunched is used as the master. If it has any blank columns, the auto-space switch should be set ON. This allows automatic spacing over blank columns. With the switch OFF the machine stops when it reaches the first blank column on the card in the master card rack. In every case in which the duplicating device is used for corrections or replacement of damaged cards, the new card must be completely checked to determine that all columns are punched identically with the original except for corrected portions. This is accomplished by placing the new card in front of the original card and checking the holes, column for column, from the front and from the back.

When the duplicating mechanism is not being used, it is very important that the operator remember to keep the master card bar in a raised position. Failure to do this would damage the machine.

Skipping and Skip Bars

Many different card forms are used in many installations, depending upon the type and variety of source records.

Occasionally, one or more fields of the cards are to remain unpunched. This occurs when a particular item of information is not required for certain records. It therefore becomes necessary to ignore these fields. By inserting in the machine a high or automatic skip bar, which has been designed for this purpose, the fields to be ignored can be automatically skipped. The skip bar illustrated in Figure 10A is designed to skip columns 1 to 39 automatically.

In other cases, certain fields normally are to be punched but occasionally skipped due to the lack of specific information on the source document. A low or X-skip bar (Figure 10B) may be inserted to perform skipping with the depression of either the X-key on the numerical keyboard (punches an X at the same time) or the skip key on the alphabetic keyboard (does not punch a hole). It should be emphasized that while skipping is possible with this type of bar, it can

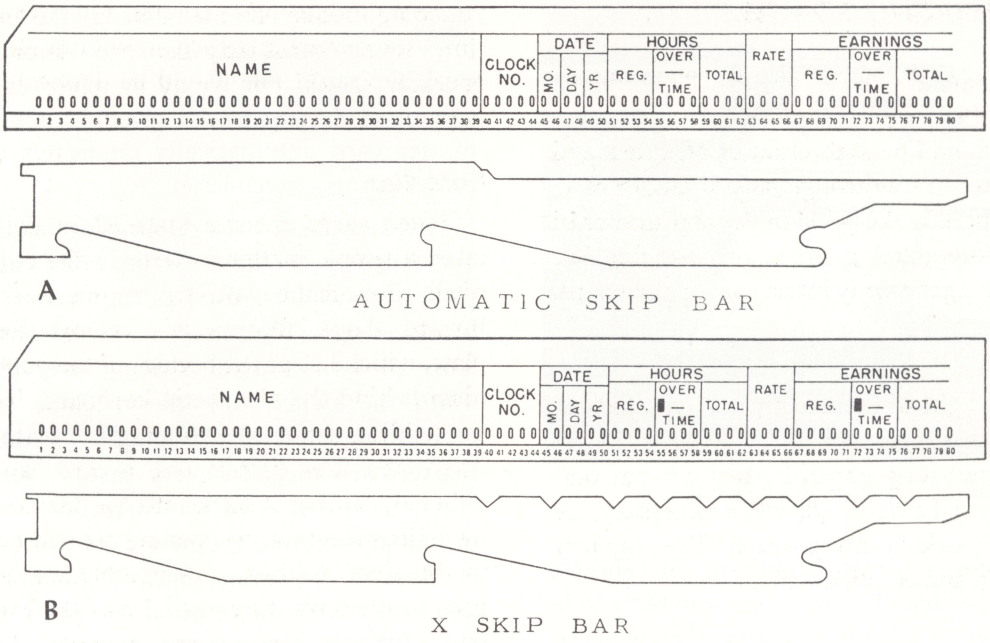


FIGURE 10. SKIP BARS

be ignored completely by the operator whenever there is information to record. The use of this type of skip bar may be compared to setting the tabular stops on a typewriter and depressing the tabular key at the option of the operator.

Because alphabetic fields on the card are designed to accommodate the maximum number of characters necessary for a given name or description, it is rare that an alphabetic field is punched in its entirety. Consequently, an X-skip bar should be used to skip the unpunched portions of the field, and the skip is started by the depression of the skip key on the alphabetic keyboard. It should be emphasized that the X-key on the numerical keyboard should never be used for skipping unpunched portions of an alphabetic field, because it punches a hole in the eleventh position.

As may be seen from Figure 10B, the X or low bar is notched at the beginning of each field that may or may not have to be skipped.

The procedure for inserting either bar in the machine is exactly the same (Figure 11). The rack that holds the skip bar lies directly above the card bed of the machine. In order to expose the skip bar rack, the carriage must be in a released position. When the rack is released, two raised buttons can be seen. The bar is held in the right hand and the pointed end is inserted into the machine first. Keep the bar close to the shaft of the machine. Slip it into position until the cut portion of the bottom of the bar slides behind the raised buttons. When in this position, the spring latch at the left end of the bar will readily snap over the rectangular end of the bar, locking it into position. It is not necessary to force the bar if it has been properly inserted. The skip bar may be readily removed with the right hand if the spring latch is released by depressing the button on the reverse side of the rack with the left hand.

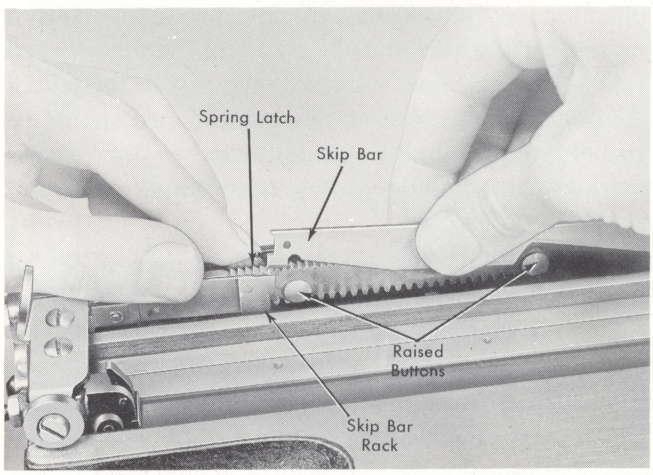


FIGURE 11. INSERTING A SKIP BAR

OPERATING POINTERS

SEVERAL FACTS regarding machine upkeep are important to the proper operation of the machine.

The machine should be kept clean at all times and not allowed to deteriorate through lack of proper care. Every operator should take pride in the appearance of her machine. Before starting to use the machine, see that the cord is plugged firmly into a source of current.

Chip Box

Slightly to the right of the machine, as you look at it from the rear, is a removable box, which is the receptacle for the punching chips as they are cut out. This box can be easily removed, when necessary, by lifting a catch that locks it into position. The chip box should be removed and emptied daily.

Fuses

If the machine fails to operate when the main-line switch is on (white button in), and the machine is properly plugged to an electrical outlet, the cause of failure may be a blown-out fuse.

Two fuses housed in holders are located in the upper left-hand corner at the rear of the machine. Each fuse is easily removed by turning its holder counterclockwise to unlock it from its frame. One end of the fuse fits loosely into the holder, and the fuse is removed by simply pulling it from the holder.

Blown-out fuses, which are easily recognized by blackened condition or broken filament, should be replaced with new ones of the same amperage. Before taking the fuse from the machine, be sure the main-line switch is off (black button in).

Cards Fail to Feed

Unsatisfactory atmospheric conditions, particularly damp weather, create a slight warp in the cards, which may cause trouble in automatic feeding. It is good practice for an operator to fan and flex each group of cards before placing them in the hopper to compensate for the warp.

Another cause for failure may be the fact that the card weight is not placed on top of the cards in the hopper.

When failures occur, the last or bottom card is usually damaged. The card knife, as it slides under the card, may damage the right end; the throat to the punching mechanism may damage the left end. Sometimes several cards may have been damaged. If so, the operator should remove all damaged cards from the hopper and destroy them.

Card Jam

When cards become jammed in the punch, it is often a simple matter to remedy the condition. First of all, turn off the main-line switch. Push the carriage inward about half-way and remove the card guide plate, which lies at the bottom of the punching mechanism behind the alphabetic keyboard, by unscrewing the holding screw and slipping the plate out (Figure 9). When this plate is out, a card can be removed either by sliding it back into the hopper by hand, or by pulling it out of the opening created by the removal of the plate. A thin saw-edge blade may have to be used to clean out tiny particles of the card if they are stuck between the die and stripper. The operation must be carefully performed; and if the blade does not move freely, the supervisor must be called. The card guide plate should be inserted in its original position before continuing with the operation.

Motor Jam

Occasionally, the drive motor that operates the carriage becomes disengaged and starts to hum. Turn off the main-line switch, remove the cards from the hopper and replace the card weight. Determine if a card has been jammed; if so, remove the card guide plate and pull out the card. Replace the guide plate. Turn on the current and hit the release key simultaneously, and the jam should be cleared.

Checking Registrations

The punching registrations of the machine should be checked daily. Punch a card in all 80 columns and check the registrations on a card gage (Figure 12). Off-gage punching causes difficulty when the cards pass through other types of machines, and this precaution is extremely important.

HOW TO OPERATE THE DUPLICATING PUNCH

Without Duplicating

1. Place the source documents on the reading board at the left of the alphabetic keyboard.

2. Raise the eject-stop lever and depress the release key.

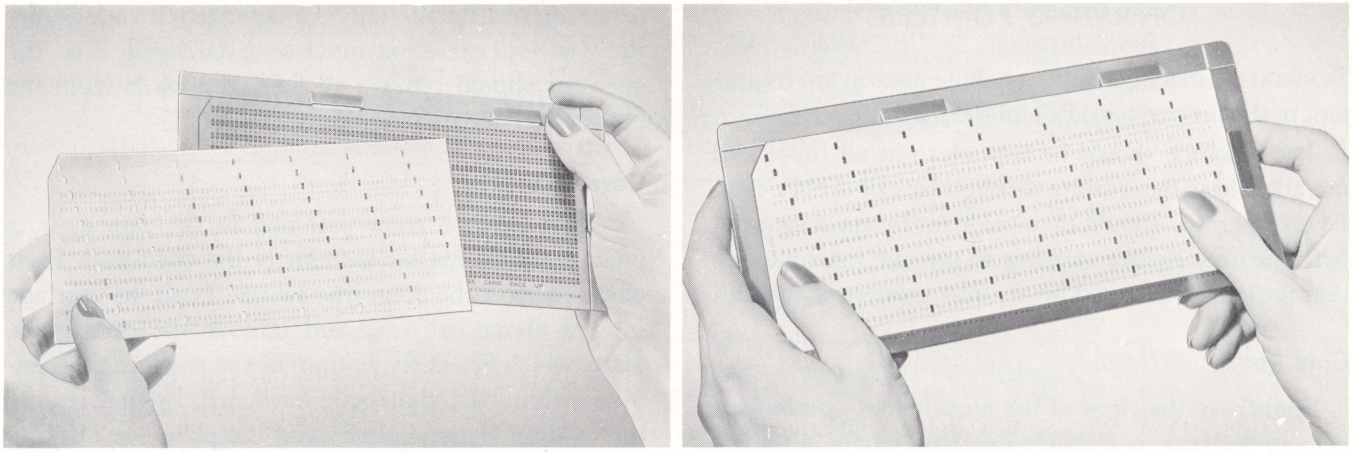


FIGURE 12. CARD GAGE

3. See that the master-card door is raised.

4. Insert the proper skip bar, if necessary.

5. Joggle blank cards, place them face up in the hopper and cover them with the card weight.

6. If no punching is required in column 80, set the release key-eject switch on and the automatic-eject switch off. If punching is required in column 80, set the switches in the reverse manner.

7. Set the main-line switch on; the auto-space switch off.

8. Lower the eject-stop lever. The first card automatically feeds into punching position. An automatic skip bar may cause it to skip to a predetermined punching position.

9. Read the source document and punch information in the cards. Most card forms are designed so that reading and punching follow the same sequence. The operator should learn the sequence and size of each field.

10. When the card is completed, it is automatically ejected into the stacker, and a new card is fed from the hopper.

11. Continue operation until all cards have been punched.

12. Turn off the main-line switch when finished.

NOTE: When an error is made while punching blank cards from an original document, the operator should immediately release the card from the machine, tear it through the center and drop it in a waste-basket.

When an error is made while punching from written information on the card itself, or while completing a partially prepunched card, the incorrect card must be immediately referred to the supervisor for instructions as to proper disposition.

With Duplicating

The procedure is the same as just described, except for Step 3. The master card should be placed in the master card rack and the door locked across the face of the card. It should be emphasized that the duplicated portion of the keypunched cards should be checked with the master card. They should all be alike. This applies to duplicated cards made over on account of damaged edges. To replace master cards, automatic ejection and feeding must be prevented by raising the eject-stop lever.

REVIEW QUESTIONS

1. What is the purpose of the Type 31 Duplicating Punch?
2. Why are there two keyboards?
3. What is the purpose of key interlocking?
4. What is the purpose of the column indicator?
5. How many keys comprise the numerical keyboard?
6. Which keys on the numerical keyboard do not punch holes?
7. Define *field*.
8. What keys on a standard typewriter are dummy keys on the Type 31?
9. Why cannot the *L* key be used to record a *1* into an IBM card?
10. What two keys on the alphabetic keyboard control the ejection of cards into the stacker?
11. Because there are only 12 punching positions in a column of the card, how is it possible to record the 26 letters of the alphabet?

12. In what manner does the X-key on the alphabetic keyboard differ from the X-key on the numerical keyboard?

13. What is the purpose of the eject-stop lever?

14. The machine has an automatic feed and eject feature. When is hand feeding ever used?

15. Why is automatic feed and eject preferable to hand feeding?

16. What controls the automatic flipping of cards into the stacker?

17. What is the purpose of the duplicating mechanism?

18. What precaution should be taken when the duplicating mechanism is not in use?

19. What is the purpose of skip bars?

20. Explain the procedure for inserting a skip bar into the machine.

21. What three things may cause the machine to fail to operate?

22. If cards fail to feed from the hopper, what may be the reasons?

23. Explain the procedure for removing cards jammed in the machine.

24. What should you do if a motor jam occurs?

25. Why should punching registrations be checked daily?

TYPE 24

THE TYPE 24 Card Punch (Figure 13) can be used to punch numerical, alphabetic, and special character information. Any one of three keyboards is available:

1. Numerical keyboard only.

2. Combination numerical and alphabetic keyboard (three special characters).

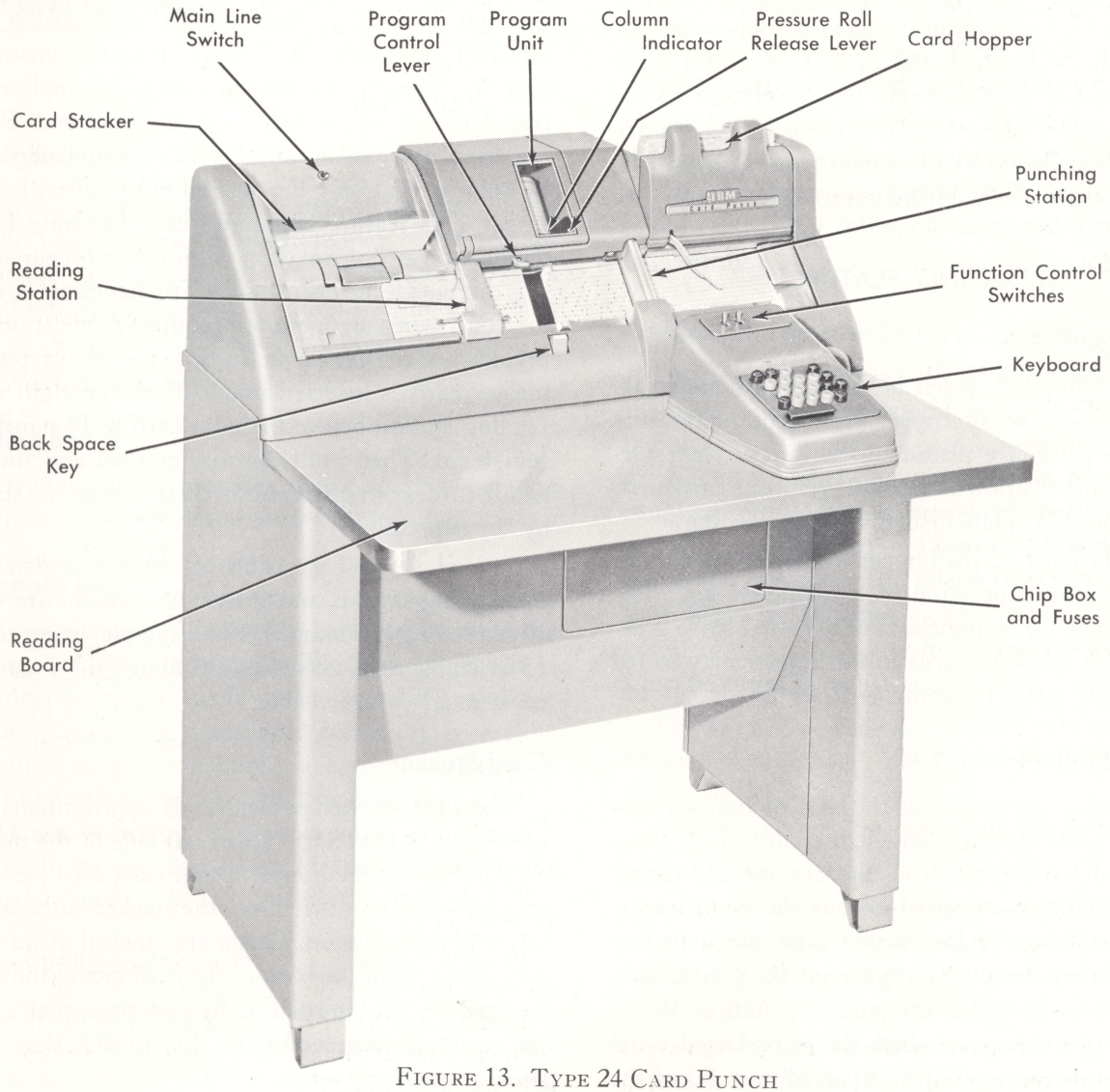


FIGURE 13. TYPE 24 CARD PUNCH

3. Combination numerical and alphabetic keyboard (eleven special characters).

The keyboard is connected to the punch by a cable and can be moved anywhere on the reading board to suit the convenience of the operator.

On the combination numerical and alphabetic keyboard, a group of the right-hand keys serves for punching digits, as well as letters, with the shift from one to the other automatically made by a program card. This permits the operator to punch an alphabetic field with both hands and, without shifting from the *home* position, to punch a numerical field with the right hand only. This frees the left hand for document handling.

A light depression of a key on the keyboard causes a punch or punches to be electrically driven through the card, thereby cutting one, two, or three holes in the column that correspond to the key depressed. As each column is punched, the card is advanced automatically to the next column. This is similar to the action that takes place on a typewriter as letters are typed on paper. As the card moves from right to left, the columns are punched from left to right.

OPERATING FEATURES

Card Hopper

The card hopper, which holds approximately 500 cards, is located on the upper right side of the machine. The cards are placed in the hopper, face forward with the 9's down, and are fed front card first. A sliding pressure plate insures uniform feeding.

A card is fed from the hopper to the card bed automatically or by depression of a card feed key. The first two cards to be punched must be fed by key depression, but all other cards in the hopper may be fed automatically under the control of a switch.

Punching Station

Punching is performed at the first of two stations in the card bed through which the cards pass from right to left. Normally, to start an operation, two cards are fed into the card bed at the right of the punching station. As the second card is fed in, the first card is automatically registered for punching—that is, it is positioned at the punching station. While the first card is being punched, the second card waits at the right of the card bed. When column 80 of the first card passes the punching station, the second card is registered at the punching station, and the next card in the hopper is fed into the right of the card bed.

A single card may be placed in the card bed by hand and registered in punching position by key depression. The whole card is visible before it is registered, and at least 71 columns are visible after punching has started. For example, when column 15 is to be punched (Figure 14), columns 1-12 and columns 22-80 are visible. Cards with lower left corner cuts can not be fed through the card bed.

Reading Station

The reading station where the cards are read for duplicating is located approximately the distance of one card to the left of the punching station. Consequently, each card that has been punched passes through the reading station as the next card is being punched. The two cards move in synchronism, column by column, and information to be duplicated is transferred from the first card to the second. Punching from one card to another can be controlled, field by field, so that only the desired information is duplicated. This feature eliminates card handling for the duplication of information from cards prepared during the punching operation. Card handling is necessary only when an operation requires duplication from prepunched master cards. In this case, the prepunched master card is inserted manually at the right of the reading station before the next card to be punched is registered. Then both the master card and the next detail card are registered at their respective stations by key depression.

The whole card is visible before it is registered at the reading station, and at least 68 columns are visible after reading has started. For example, when column 15 is being read, columns 1-8 above the 7 row and columns 21-80 are visible.

Card Stacker

The card stacker, which holds approximately 500 cards, is located on the upper left side of the machine on a level with the hopper. After each card passes the reading station, it is fed into the stacker automatically or by key depression. Cards are stacked at an angle, 12's down, with the back of the card facing the operator, and are held in position by a pressure plate. When the cards are removed from the stacker, they are in their original sequence.

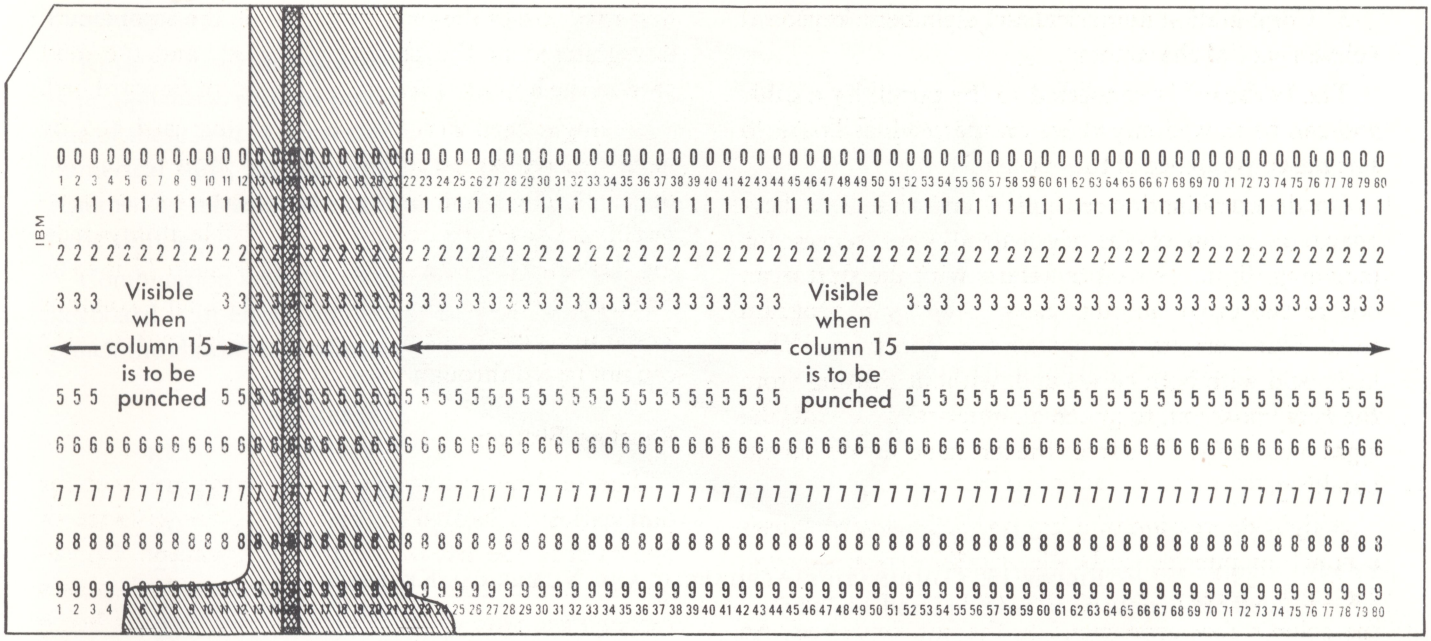


FIGURE 14. CARD VISIBILITY AT THE PUNCHING STATION

Main-Line Switch

The main-line switch is located at the rear of the stacker. Operation of the machine may be started approximately one minute after the main-line switch is turned on, to allow sufficient time for the electronic tubes to heat. When the stacker is full, the switch is thrown off automatically.

Reading Board

A reading board provides ample space for source documents from which the cards are punched.

Backspace Key

This key is located below the card bed between the reading and the punching stations. As long as it is held depressed, the cards at the punching and the reading stations are backspaced continuously. At the same time, the program card, which controls skipping and duplicating, is also backspaced. Backspacing should not be attempted after column 78 is passed, without first removing the card in the card bed at the right.

Column Indicator

The indicator, located at the base of the program drum holder, indicates to the operator the next column to be punched. The numbers are scaled around the base of the drum holder. The drum holder turns as the cards are being punched. Spacing or backspacing to a particular column is facilitated by reference to the indicator.

Pressure Roll Release Lever

Depression of the pressure roll release lever permits the removal of a card caught at the punching or reading station. Normally, a card can be removed in one piece if it is pulled out with care. If torn pieces are caught at either station, however, they can be pushed out with another card or a smooth-edged metal blade, while the pressure roll release lever is held down. Saw-edged metal blades should not be used.

Chip Box and Fuses

The chip box is located under the reading board. When it is removed, the fuses for the machine are accessible.

Keyboards

On all keyboards, the punching keys are gray with blue lettering, and the control keys are blue with white lettering. The home keys are more concave than the other keys to facilitate accurate touch operation. The keyboards are so interlocked that no two keys can be depressed at the same time, but it is not necessary to

FIGURE 15. COMBINATION ALPHABETIC AND NUMERICAL KEYBOARD

wait for one key to rise before depressing another. This design permits "rolling" of keys. Multiple digits may be punched manually in one column by holding the space bar down while the keys are depressed. On some machines, a multiple punch key is supplied for this purpose.

The combination keyboard (Figure 15) has the best features of both a typewriter and a numerical keypunch. The letter keys are arranged for operation by the standard typewriter touch system, while the digit keys are placed so that a rapid three-finger touch system can be used. The usual numerical keys on a typewriter have been eliminated; instead, a group of dual-purpose keys at the right serves for digit as well as letter punching. This permits numerical punching with the right hand from the normal home position for alphabetic punching. The touch system for these ten numerical keys is: index finger for digits 1-4-7, middle finger for digits 2-5-8, and ring finger for digits 0-3-6-9. The punching of a digit or a letter with any of the combination keys depends upon the shift of the keyboard. For example, depression of the 4-J key punches a 4 when the keyboard is in numerical shift, but a J when in alphabetic shift. This shifting is similar to upper or lower case shifting on a standard typewriter and may be controlled automatically by the program unit or manually by key depression. The section containing the combination keys is readily distinguishable by the blue keyplate.

COMBINATION KEYBOARD

ON THE combination keyboard chart (Figure 16) each key is numbered for purposes of description.

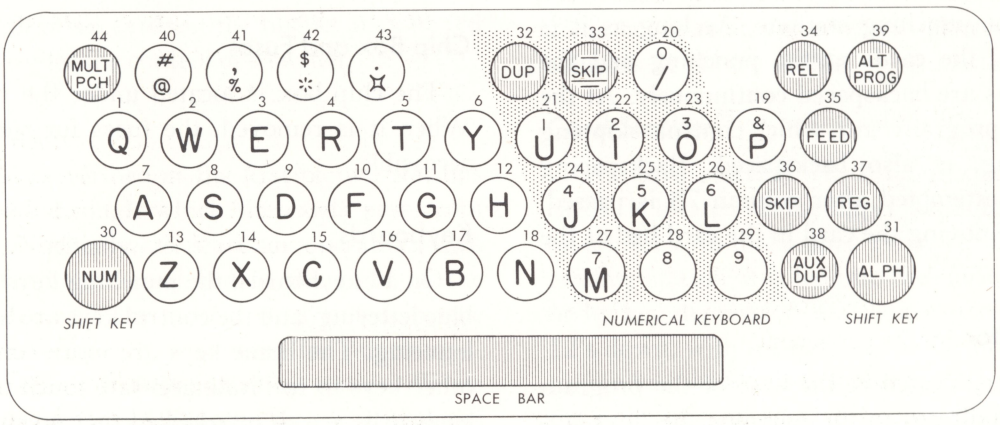


FIGURE 16. KEYBOARD CHART

Punching Keys

Keys 1-18 can be depressed only when the keyboard is in alphabetic shift to punch the letters indicated. If one of these keys is depressed while the keyboard is in numerical shift, the machine locks. Operation can be resumed by releasing the card or depressing the alphabetic shift key.

Combination keys 19-29 can be depressed when the keyboard is in either numerical or alphabetic shift to punch the characters indicated below.

KEY	NUMERICAL SHIFT	ALPHABETIC SHIFT
19	& (12)	P
20	0	/ (0,1)
21	1	U
22	2	I
23	3	O
24	4	J
25	5	K
26	6	L
27	7	M
28	8	8
29	9	9

Space Bar

The space bar can be depressed at any time to cause spacing over one column of the card. If a machine is not equipped with a multiple-punch key, the space bar may be held down to permit multiple punching in the same column.

Functional Keys

30. NUM (numerical shift) shifts the combination keyboard into numerical position as long as it is held down. It is normally used to punch numbers in an otherwise alphabetic field.

31. ALPH (alphabetic shift) shifts the combination keyboard into alphabetic position as long as it is held down. It is normally used to punch letters in an otherwise numerical field.

32. DUP (duplicate). With program control it causes duplication of the field for which it is depressed at the rate of 20 columns per second.

Without program control it duplicates at the rate of 10 columns per second only as long as the key is depressed.

33. -SKIP (or)-. In numerical shift punches an 11 (-) and causes skipping of the field for which it is depressed; in alphabetic shift punches an 11 (-) only.

34. REL (release) causes the cards at the punching and reading stations to be advanced completely past those stations. Fields programmed for automatic duplication beyond the point of release are punched in the card before release is completed.

35. FEED (card feed) causes a card feed cycle:

a. Feeds a card from the hopper.

b. Registers the cards at the punching and reading stations.

c. Stacks the card from the left of the card bed.

36. SKIP causes skipping of the field for which it is depressed. It is normally used for skipping the unused right-hand portion of an alphabetic field.

37. REG (card register) is used primarily when inserting cards manually:

a. Registers the cards at the punching and reading stations.

b. Stacks the card from the left of the card bed.

38. AUX DUP (auxiliary duplicate) is supplied only when the machine is equipped with the auxiliary duplication feature. It causes duplication from the master card on the auxiliary duplicating drum. One depression duplicates the entire field from the master card.

39. ALT PROG (alternate program) is supplied only when the machine is equipped with the alternate program unit. This key is depressed, either at the beginning or during the card cycle, for each card requiring alternate instead of normal program control.

40-43. These eight special characters are used on the Type 407 Accounting Machine. They are available only on the number 3 keyboard.

44. MULT PCH (multiple punch) is held down to prevent normal spacing of the card so that more than one digit can be punched in a column. The keyboard is in numerical shift when this key is depressed.

Switches

Automatic Skip and Duplicate. When this switch is turned ON, the program punching for automatic skipping and automatic duplicating is effective. When

this switch is turned OFF, the 11 (start automatic skip) and 0 (start automatic duplication) codes in the program card are nullified.

Automatic Feed. When this switch is turned ON and column 80 of the card passes the punching station, a new card is fed automatically. At the same time, the card in the left of the card bed is stacked, the one in the center is registered at the reading station and the one at the right is registered at the punching station. This automatic feeding occurs when column 80 of the card passes the punching station by any one of three possible operations: punching, skipping, or releasing.

Numerical Punching

Punching numerical information is simply punching holes representing particular digits (0 to 9) in predetermined columns of the card. If for example, a 3 and a 7 are punched in two successive columns, the number 37 is recorded for use in operations such as printing, accumulating, classifying, reproducing, filing, and multiplying when that card is fed through one of the other machines. What this number represents is determined by the card field heading. The term *field* is used to describe a column or group of columns set aside by vertical lines for a particular item of information. Thus, the number 37 may represent year, location, warehouse, quantity or amount. If a serial number should appear in the first 8 vertical columns of the card, and read 36214901, the 3 would be punched in the first column, the 6 in the second, and so on, as shown in Figure 17.

If the serial number to be punched in an 8-column field has only five digits as 56074, columns 1, 2, and 3 would be punched with zeros in order to keep the significant digits 5, 6, 0, 7, and 4 in their proper relation to other serial numbers.

In addition to the punching of the digits (0 to 9), special indications are punched in the 11 and 12 positions. The *11* is punched by depression of the -skip key, and the *12* by the ampersand key on the combination keyboard (12 key on the numerical keyboard).

Alphabetic Punching

The recording of letters in IBM cards is accomplished by keys on the combination keyboard. As previously stated, there are only twelve punching positions in each column of the card. Because there are 26 letters

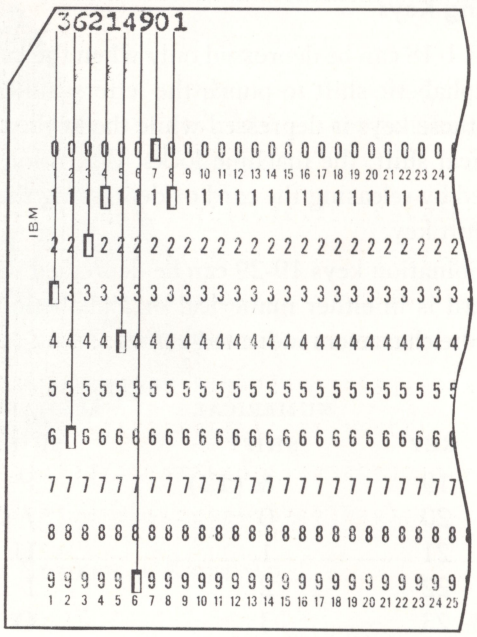


FIGURE 17. NUMERICAL PUNCHING

in the alphabet and only 12 possible positions in which to record a letter, it therefore is necessary to punch two holes in a column for each letter. This requires a low or numerical punch (1-9) in combination with a high or zone punch (0-11-12). Thus, the punching for each letter of the alphabet is as follows:

FIRST ZONE 12 punch in combination with	SECOND ZONE 11 punch in combination with	THIRD ZONE 0 punch in combination with
1-A	1-J	
2-B	2-K	2-S
3-C	3-L	3-T
4-D	4-M	4-U
5-E	5-N	5-V
6-F	6-O	6-W
7-G	7-P	7-X
8-H	8-Q	8-Y
9-I	9-R	9-Z

The two holes for any given letter of the alphabet are punched simultaneously by one depression of an alphabetic key. For example, the complete alphabet, punched with 26 key depressions in columns 25 to 50, would appear as shown in Figure 18.

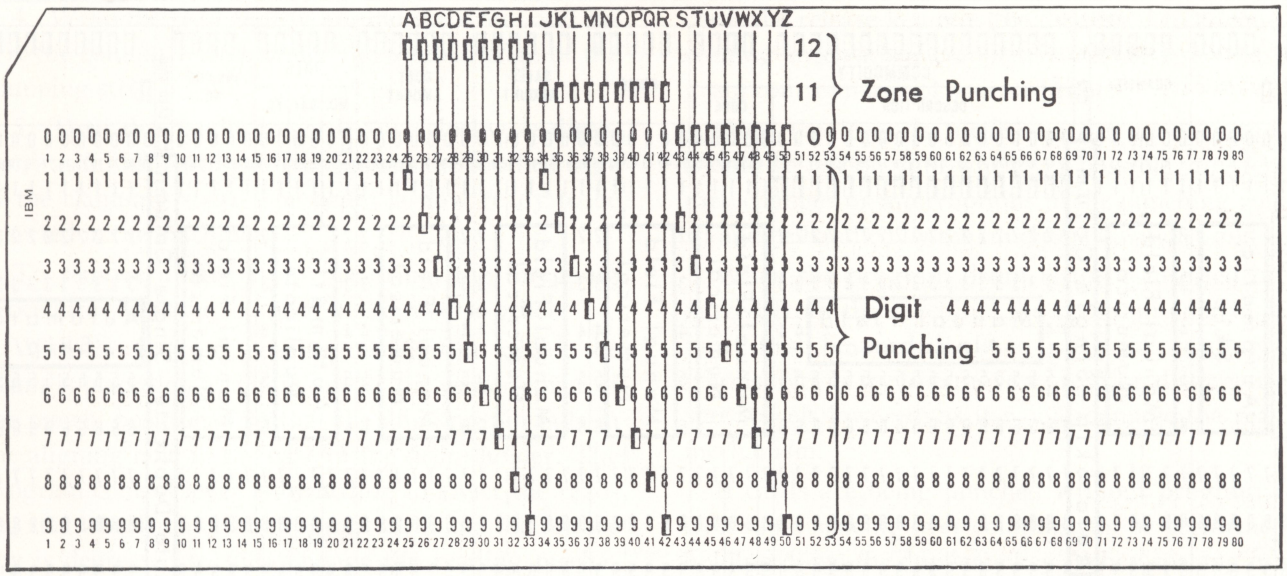


FIGURE 18. ALPHABETIC PUNCHING

PROGRAM CARD

A PROGRAM CARD, which is a basic part of the program unit, is prepared for each punching application and can be used repeatedly. Proper punching in this program card controls the automatic operations for the corresponding columns of the cards being punched.

The control punching required in the program card depends on the functions to be performed, that is, skipping, duplicating, and alphabetic punching. Each row in the program card serves a specific purpose in this respect.

Field Definition

A 12 hole should be punched in every column except the first (left-hand position) of every field to be skipped, duplicated, or manually punched. These 12's serve to continue to the end of a field any skip or duplication started within that field. Several consecutive fields to be skipped or duplicated automatically as one field should be programmed as a single field.

The 12's are punched in the program card for manually punched fields to permit occasional skipping or duplicating. This skipping or duplicating is started by key depression and is carried across the field by the 12's. This type of skipping is similar to an X-level skip on other IBM key punches; the occasional duplicating may be desired in the case of two or more cards with the same information, or in duplicating the correct fields of an error card.

Automatic Skip

An 11 hole punched in the first column of any field automatically *starts the skip,* which is continued over that field by the 12's punched in the remaining columns of the field. If a single column is to be skipped automatically, it is punched with an 11. This coding operates in conjunction with an automatic skip and duplicate switch, which must be on to start the skipping automatically.

Automatic Duplication

A zero punched in the first column of any field automatically *starts duplication,* which is continued over that field by the 12's punched in the remaining columns of the field. If a single column is to be automatically duplicated, it is punched with a zero. This coding operates in conjunction with an automatic skip and duplicate switch, which must be on to start the duplicating automatically.

Alphabetic Punching

When the program card is in the machine, the combination keyboard is normally in numerical shift, and the depression of any one of the two-purpose keys causes a figure to be punched. In order to punch a letter, the combination keyboard must be shifted for alphabetic punching. This shifting is performed automatically by a *1* in the program card in each column

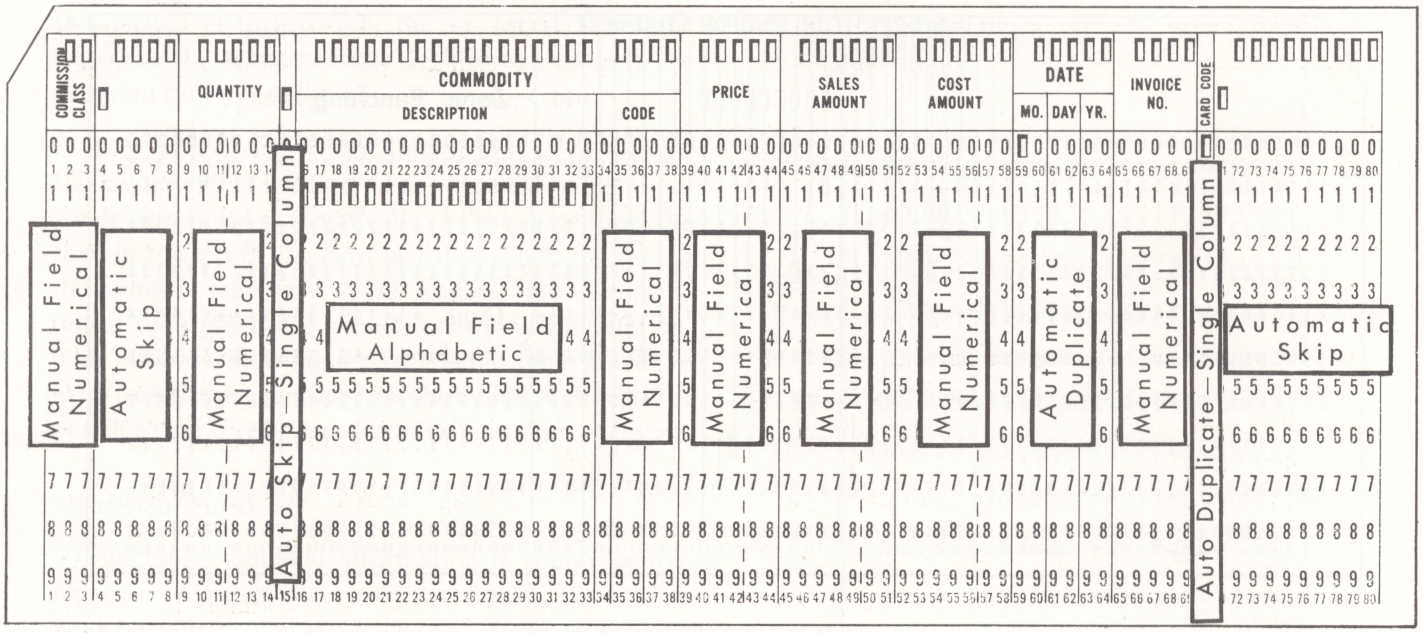


FIGURE 19. PROGRAM CARD

of the alphabetic field. During duplication of alphabetic information, the 1's permit automatic spacing over blank columns, and prevent X-skipping caused by letters containing X-punches (J-R).

The four basic program codes are summarized below and illustrated in Figure 19.

CODE	FUNCTION
12	Field Definition
11	Start Automatic Skip
0	Start Automatic Duplication
1	Alphabetic Shift

The other digit rows in the program card control functions in conjunction with either optional features or the Type 26 Printing Card Punch.

PROGRAM DRUM

THE PROGRAM CARD is mounted on a program drum for insertion in the machine. The program drum has a clamping strip to hold the card, and a handle on the top to tighten or release the strip. To fasten a card around the drum (Figure 20), the following steps should be taken:

1. Hold the drum in a horizontal position with the handle to the right. Turn the handle away (counterclockwise direction) as far as it will go. This loosens the smooth edge of the clamping strip.

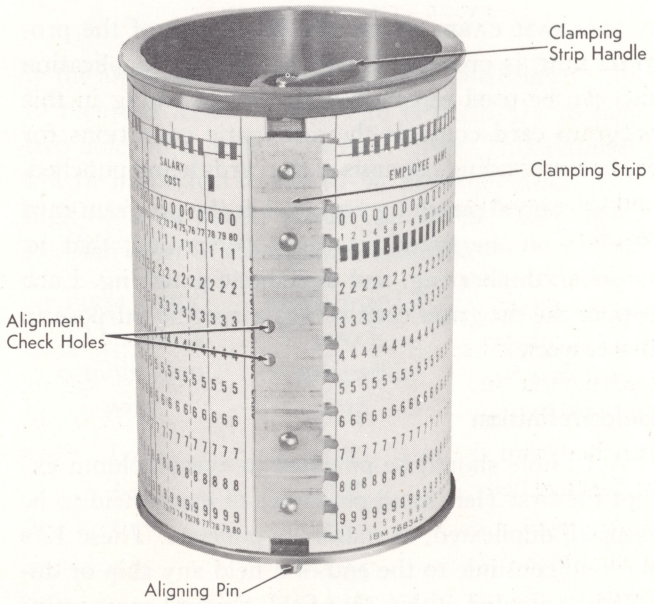


FIGURE 20. PROGRAM DRUM

2. Insert the column-80 edge of the card under the smooth edge of the clamping strip. Two alignment check holes in the clamping strip make it possible to see that the card is flush with the metal edge under the strip. The card should be positioned so that the 9's edge is against the rim of the drum.

3. Turn the handle to the center position. This tightens the smooth edge of the clamping strip and loosens the toothed edge.

4. Wrap the card tightly around the drum and insert the column 1 edge under the toothed edge of the clamping strip.

5. Turn the handle toward you (clockwise direction) as far as it will go. This fastens the toothed edge of the clamping strip. The drum is now ready to be inserted in the machine.

To remove a card from the drum, the foregoing procedure should be followed in the reverse order.

With the program sensing mechanism raised, the drum is placed on a spindle under the center cover of the punch, positioned so that the aligning pin falls in the aligning hole in the base of the drum holder. The program control lever is turned on to lower the reading star wheels onto the program card, and the release key is depressed to fully engage the reading mechanism. Whenever the drum is to be removed, the program control lever must first be turned off to raise the star wheels.

OPERATING POINTERS

WHENEVER you turn the main-line switch off, be sure that there are no cards in the card bed. If the switch is turned off and then on again with a card registered at the punching station, the keyboard becomes locked and the card must be released before operation can be resumed.

To start an operation, feed two cards from the hopper to the card bed by depressing the feed key twice. Do not use the release key (with the automatic feed switch on) as it wastes time. After the second key depression, the first card is in position to be punched, and the second card is waiting at the right in the card bed.

Any time a single card must be manually inserted, it should be placed directly in the card bed. Single cards should not be inserted in the hopper. If a single card is to be manually inserted for punching, place it flat in the right of the card bed. If it is to be inserted for reading, place it in the center of the card bed. Slide it to the left through the two notches in the frame. The right end of the card will rest on top of the frame, but as the card moves past the reading station, it will flatten out.

To register cards for punching or reading, depress the feed or register key.

Whenever the program control lever is turned on to lower the reading star wheels onto the program card, the release key must be depressed to engage the reading mechanism completely. Otherwise, the program control may not operate properly.

Once the lever is turned on for an operation, it should be left on, and whenever possible, any temporary changes or interruptions in the punching routine should be handled by the functional switches and keys.

When the program drum is to be inserted or removed from the machine, the program control lever must first be turned off to raise the reading star wheels. Never try to remove a program drum with the star wheels lowered, as it would damage the reading mechanism.

If cards are being punched without program control, rapid spacing over columns can be performed by holding down the duplicate key. When spacing in this manner, be sure that the same columns in the card ahead are unpunched, or that there is no card ahead.

On a combination keyboard, if an alphabetic key, not a combination key, is depressed in a field programmed for numerical punching, the keyboard will be locked. This may happen, for example, if you punch a name that is too long for the name field and run over into a numerical field. To unlock the keyboard, release the card or depress the alphabetic shift key. In the latter case, the letter will be punched, and the card must be made over.

If you attempt to duplicate a blank column in a numerical field, either automatically or by key depression, the keyboard will become locked. The keyboard can be unlocked by depressing the backspace key or the alphabetic shift key on the combination keyboard. This locking will occur at the start of a job before you have set up your master information in the first card, if you have left the auto-skip and duplicate switch on. In this case, turn off the auto-skip and duplicate switch and depress the backspace key to unlock the keyboard.

The keyboard is locked when there is no card at the punching station. This makes it impossible to do any punching unless a card is in position to be punched.

When a card is registered at the punching station, the register and feed keys are inoperative. If either is depressed, the release key becomes locked. The release key is unlocked upon depression of a character key or the space bar.

When wrapping a card around the drum to insert the column 1 edge, wrap the card snugly but do not

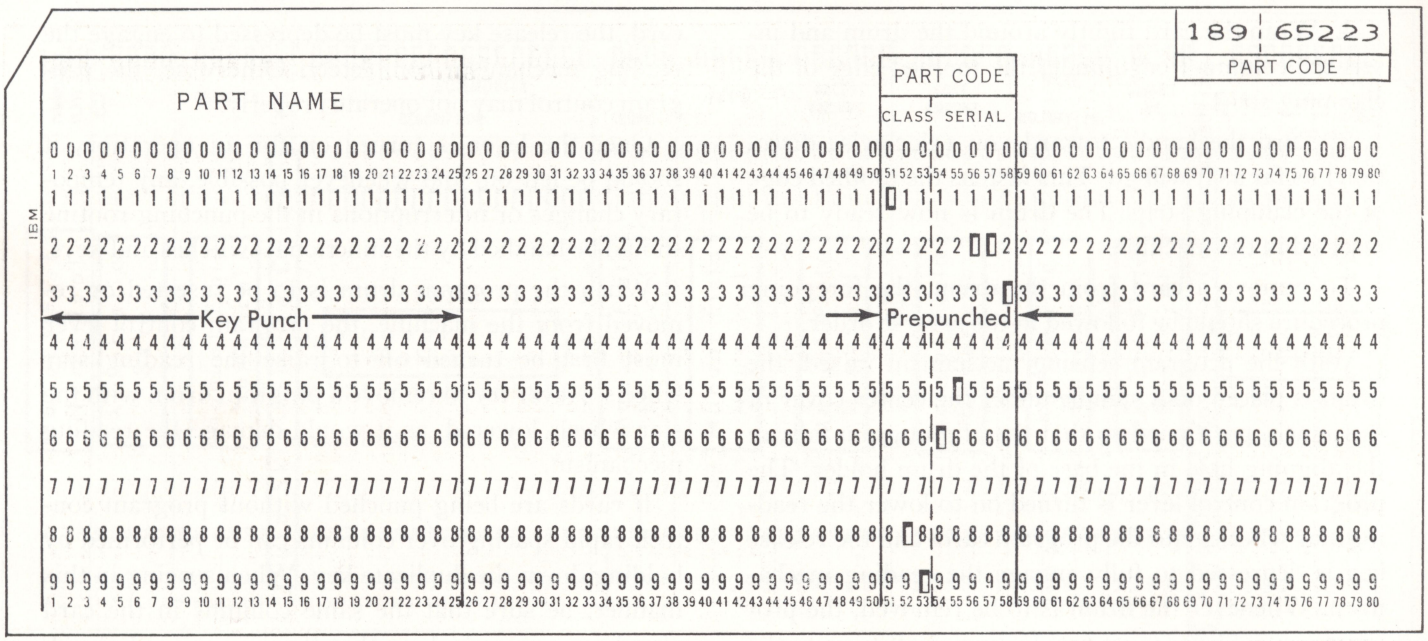


FIGURE 21. HAND FEED

pull it too tight as the column-80 edge will be pulled away from the clamping strip. When mounting a card on the drum, be sure that the punching rows fall over the grooves in the drum.

HOW TO OPERATE A TYPE 24 PUNCH

Hand Feed

In certain instances it is desirable to insert cards manually, one at a time, when making over a damaged card or correcting an error found while verifying. Also, when an individual card accompanies each original document, manual insertion is necessary. A single card should not be inserted in the hopper. It should be manually inserted in the card bed to the right of either the punching station or the reading station. Figure 21 shows a card prepunched with *part code*. *Part name* is to be punched.

1. Place the card in the card bed to the right of the punching station.
2. Depress the register key to advance the card into punching position.
3. Punch part name, starting in column 1, depressing the numerical shift key when necessary.
4. After punching the part name, release the card.
5. Insert the next card in the card bed to the right of the punching station and depress the register key. This registers the first card at the reading station and the second card at the punching station. When the release key is depressed for the second card, the first card is released to the left of the reading station. Then, when the third card is registered, the first card is moved into the stacker.

Numerical Punching with Program Control

Normally, in a punching operation, the cards are placed in the card hopper and fed into the card bed automatically. Also, as the cards are punched, the program card controls the automatic functions, such as skipping and duplicating. In this illustration, labor distribution cards are to be punched with numerical information according to the fields shown. Figure 22 shows how the card is punched to serve as a program card, indicating what type of operation is to be performed in each field. Columns 3-6 and 34-35 are to be automatically duplicated. Columns 48-80 are to be automatically skipped. All other fields are to be keypunched.

1. Place a deck of unpunched cards in the card hopper.
2. Depress the feed key twice to feed two cards into the card bed. The first card registers automatically as the second card is fed.

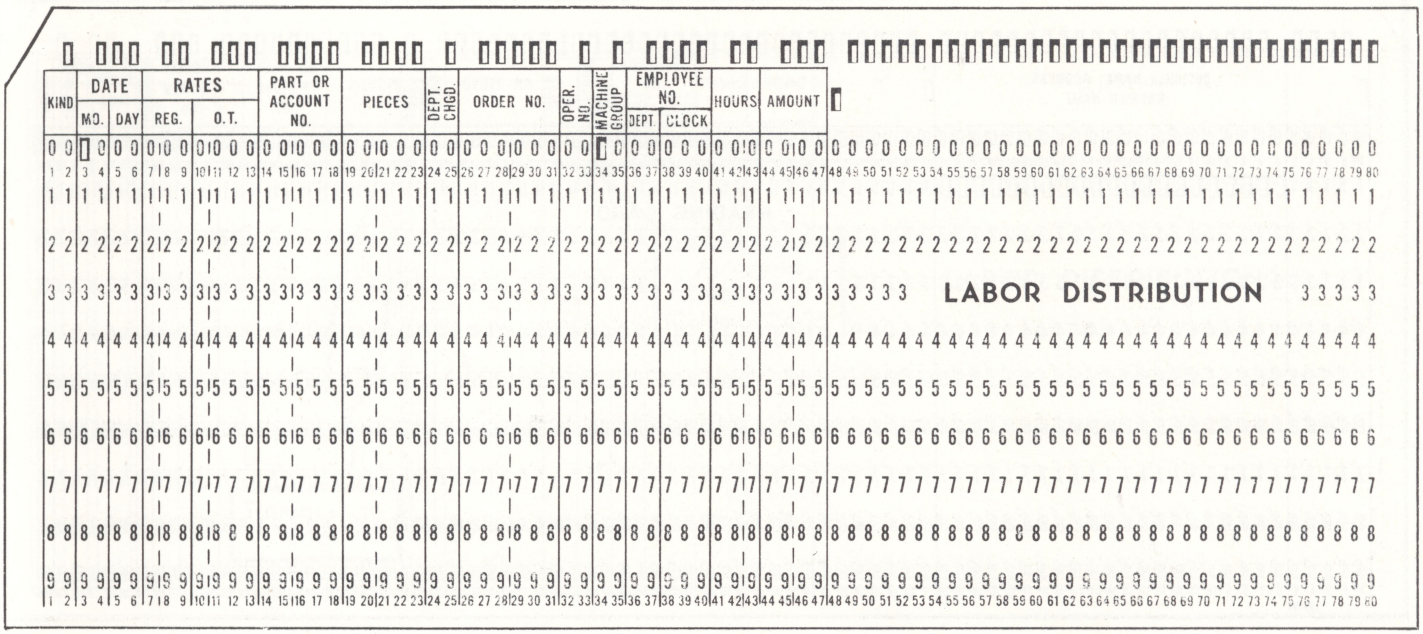


FIGURE 22. NUMERICAL PUNCHING WITH PROGRAM CONTROL

3. Keypunch columns 1 and 2 (program card punched with a 12 in column 2).

4. Columns 3-6 are programmed for automatic duplication (program card punched with 0 in column 3 and 12's in columns 4-6). The first card of each date group is keyed manually with the automatic duplicate switch OFF. Then the switch is turned ON, and the date in each succeeding card is automatically duplicated from the preceding card.

5. Keypunch columns 7-33 (program card punched with a 12 in each column except the first position of each field).

6. Columns 34-35 are programmed for automatic duplication (program card punched 0 in column 34 and 12 in column 35). In the same manner as date in columns 3-6, machine group is manually keyed for the first card of each group but automatically duplicated for the rest of the cards.

7. Keypunch columns 36-47 (program card punched with a 12 in each column except the first position of each field).

8. Columns 48-80 are automatically skipped (program card punched with 11 in column 48, and 12's in columns 49-80). The automatic skip and duplicate switch must be on.

9. An automatic feed occurs after column 80 is skipped. The automatic feed switch must be on.

Alphabetic and Numerical Punching with Program Control

Although the keyboard is normally in numerical shift when the program is turned ON, alphabetic information can be punched by changing to alphabetic shift. This is done either manually by depression of the shift key or automatically by coding in the program card. Columns 6-26 of Figure 23 illustrate the *1* coding for automatically shifting to alphabetic position.

In punching alphabetic information, it is usually desirable to skip over that part of the field that is not used. Because the starting point of this skipping varies from card to card, it must be controlled manually by depressing a skip key.

Another type of skipping that must be controlled by key depression is illustrated in the trading area field (Figure 23). The trading area code is to be punched for some customers, but not for others. In the latter case, column 75 is to be X-punched to indicate that no code was supplied, and the rest of the field is to be skipped. The 11 will be used as a control punch in later operations.

When a field is to be punched with the same information in a few successive cards, only the first card needs to be manually punched; the field in the following cards can be punched by a single key depression.

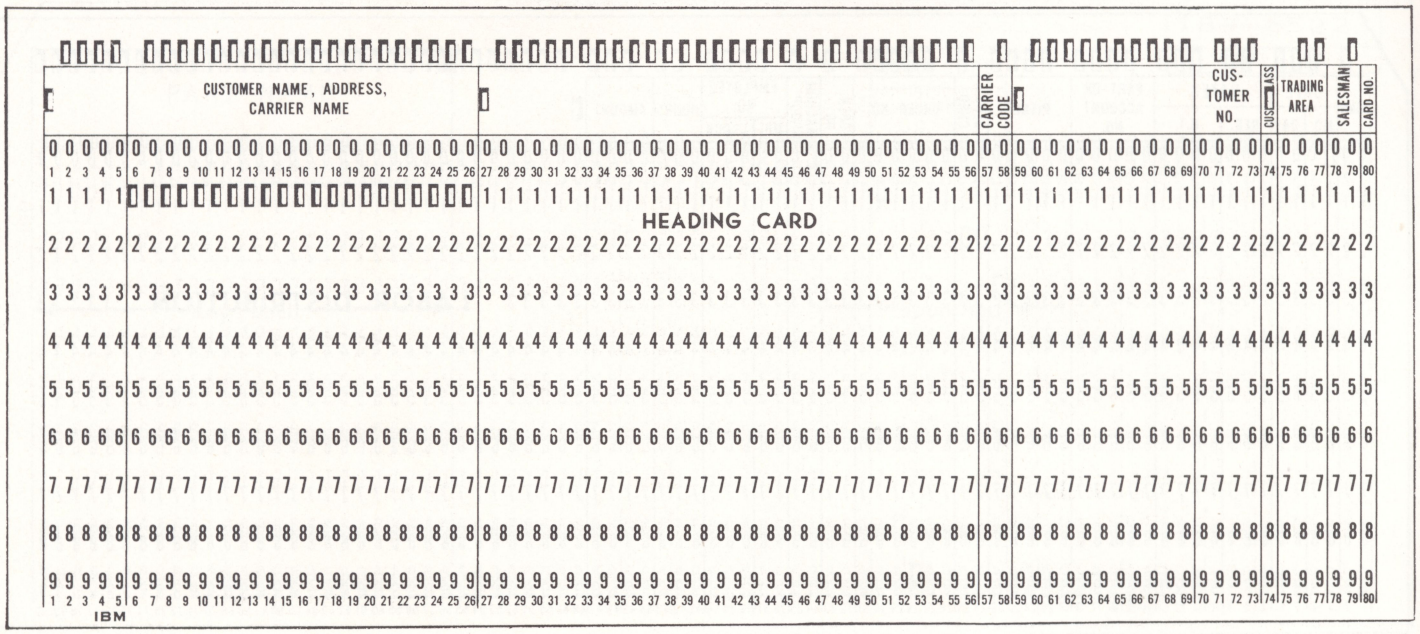


FIGURE 23. ALPHABETIC AND NUMERICAL PUNCHING WITH PROGRAM CONTROL

In this illustration, salesman number in columns 78-79 may be the same for several consecutive cards and can be duplicated by key depression.

1. Depress the feed key twice to feed two cards.

2. Columns 1-5 are automatically skipped (program card punched with 11 in column 1 and 12's in columns 2-5). The automatic skip and duplicate switch must be on.

3. Punch columns 6-26 with customer name, address, or carrier name (program card punched with 1's in columns 6-26). The 1's automatically shift the keyboard from numerical to alphabetic punching. When figures are to be punched, depress the numerical shift key.

4. Depress the skip key at the end of the alphabetic punching to skip over the rest of the field (program card punched with 12's in columns 7-26).

5. Columns 27-56 are automatically skipped (program card punched with 11 in column 27 and 12's in columns 28-56).

6. Keypunch carrier code in columns 57-58 (program card punched with a 12 in column 58).

7. Columns 59-69 are automatically skipped (program card punched with 11 in column 59 and 12's in columns 60-69).

8. Keypunch customer number in columns 70-73 (program card punched with 12's in columns 71-73).

9. Column 74 is automatically skipped (program card punched 11).

10. The trading area field is coded in the program card for manual numerical punching (blank in column 75 and 12's in columns 76-77). Optional X-skipping of the field is controlled by depressing the 11-skip key, which also punches the 11 in column 75.

11. Keypunch columns 78-80.

Error Correction

Errors in punching are often noticed and corrected by the operator at the time they are made. As an example, the correction of an error in the *pieces* field (Figure 24) is made as follows:

1. Depress the release key immediately upon detection of the error. This advances the card without punching for the fields coded for manual punching, but allows automatic duplication of fields programmed for duplication beyond the point of release. Therefore, columns 34-35 are duplicated into the error card as it is being released. This retains the common information for duplication into the following cards. The three cards in the card bed advance to their proper stations and a new card feeds from the hopper.

2. Duplicate the *kind* field by a single depression of the duplicate key.

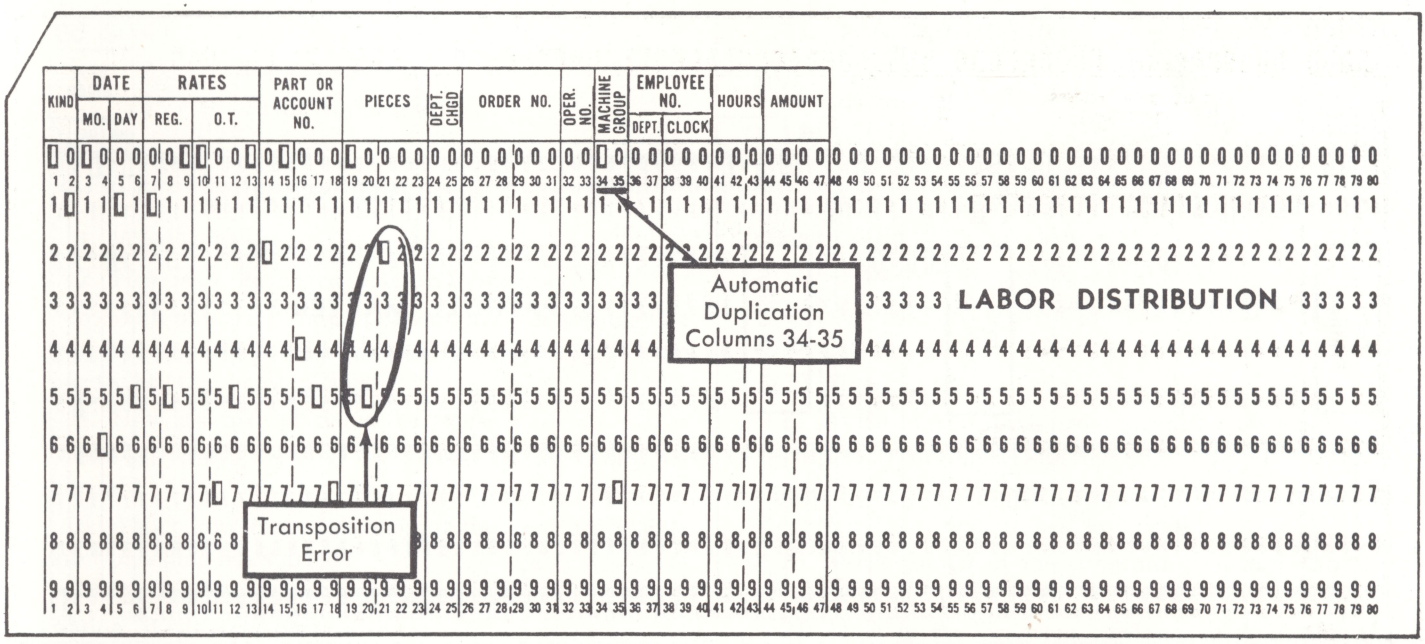


FIGURE 24. ERROR CORRECTION

3. Columns 3-6 are programmed to duplicate automatically.

4. Manually duplicate the regular rate, overtime rate, and part or account number fields by depressing the duplicate key at the beginning of each field. Duplication will stop at the end of the part or account number field.

5. Re-key the *pieces* field, and manually punch the remaining fields programmed for manual punching. The *machine group* field will be automatically duplicated, and columns 48-80 will be automatically skipped.

6. Remove from the stacker the card containing the error.

Prepunched Master Card Insertion

In an operation in which certain fields are to be duplicated from prepunched master cards, it is necessary to insert each master card manually before duplicating the first card of the group. The master cards are inserted in the card bed at the right of the reading station.

1. Turn the automatic feed switch off before completing the punching of the last card of the preceding group.

2. After the last card is released from the punching station, manually move it to the left until its left end touches the feed rolls at the reading station.

3. Depress the release key to advance that card past the reading station.

4. Place the master card in the card bed between the punching and the reading stations.

5. Depress the feed key to register the master card and the detail card which is waiting at the right in the card bed, and to feed a new card from the hopper. Turn the automatic feed switch on. Normal punching of the first card of the new group can then proceed with automatic feeding of the following detail cards.

6. If the master card is not to be stacked with the detail cards, remove it immediately after completing the punching of the first detail card.

7. This kind of operation normally precludes the possibility of automatic duplication of any common information, such as date, from one group of cards to the next, because the continuity of such duplication is interrupted by inserting the prepunched master cards. Consequently, when common punching is required, the information must be manually punched in the first card of each new group. This keying can be avoided by the use of the optional auxiliary duplicating device represented by key 38 on the keyboard chart.

Making Over Damaged Cards

It is sometimes necessary to make over cards damaged on other IBM machines. If the card is torn as a

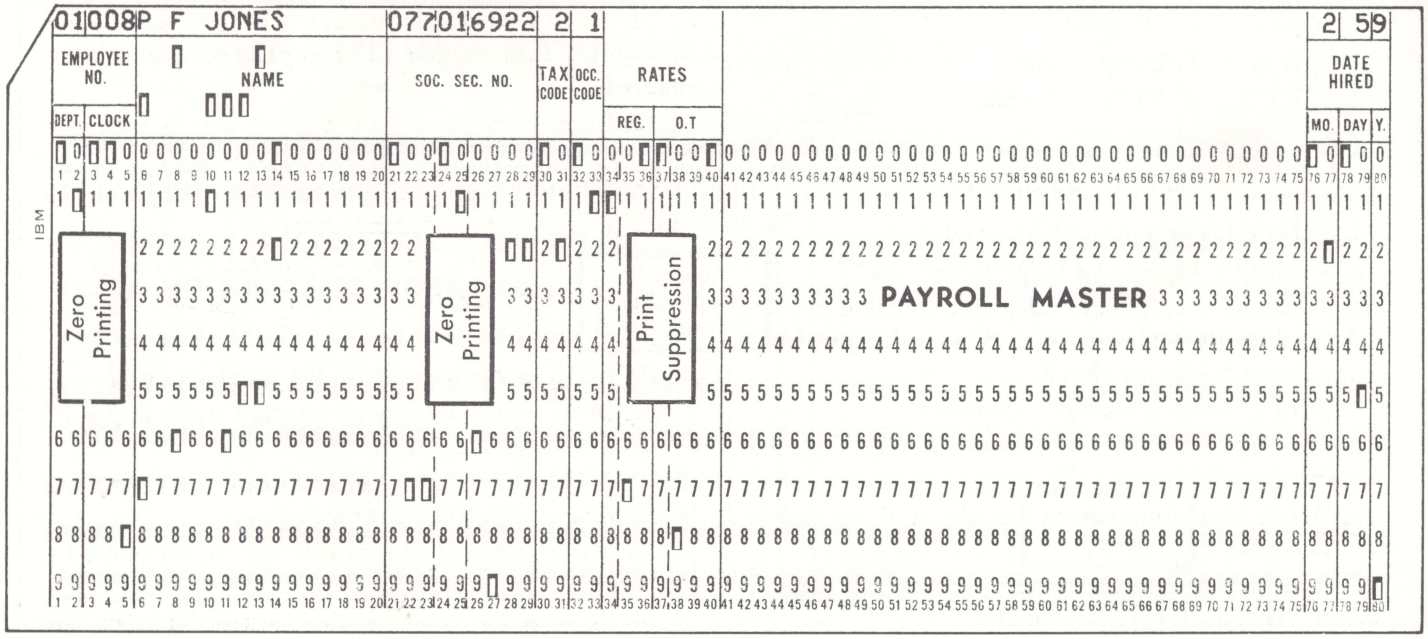


FIGURE 25. CHARACTER PRINTING

result of a jam, the pieces should be properly assembled and a new card manually punched. If the card is not torn it may be made over as follows:

1. Turn off the program control lever.
2. Place the damaged card in the reading bed.
3. Place a blank card in the punch bed.
4. Register both cards by depressing the register key.
5. Depress the DUP key until all punched columns have been duplicated. To avoid possible damage to the machine, make sure that whenever the DUP key is depressed a card is fully registered at the reading station.
6. Release both cards by means of the release key.
7. Sight check.

TYPE 26

THE TYPE 26 Printing Card Punch is the same in appearance and features as the Type 24 Card Punch. With the Type 26, however, characters are printed as they are punched (Figure 25). Each character prints above the column punched, thus permitting full interpretation of the card. The printing feature is controlled by an ON-OFF switch.

Print Suppression

The print suppression feature provides an extremely flexible control of printing. That is, even though the print switch is ON, printing can be prevented for one or more columns of the card. Print suppression for a column is controlled by a 3 punched in the program card. To suppress printing for a field, the 3 is punched for each column of the field. For example, the program card for Figure 25 would be punched 3 in columns 34-40.

Zero Printing

With program control, zeros to the left of the first significant digit in a numerical field are automatically suppressed (e.g., 00025 is printed 25). This zero suppression is determined by the 12 punching in the program card, to define the fields. For example, the program card for Figure 25 would be punched 12 in columns 77 and 79, but blank in 76 and 78, to print *month* and *day* as shown.

To print zeros to the left in a field, as in a social security number, a 2 is punched in each column of the field in the program card. For example, the program card for Figure 25 would be punched 2 in columns 1-5 and 21-29. A zero in the units position of a field always prints.

Program Card Codes

The additional codes that apply to the Type 26 only are summarized as follows:

CODE	FUNCTION
2	Left Zero Print
3	Print Suppression

REVIEW QUESTIONS

1. What is the purpose of the card punch?
2. How is the keyboard attached to the punch?
3. Both numerical and alphabetic information may be punched from the same keyboard. How is the shift from one to the other accomplished?
4. How are cards placed in the hopper?
5. How must the first two cards be fed from the hopper?
6. About how many columns of the card are visible after punching has started?
7. The machine contains a reading station and a punch station. What is the purpose of each?
8. How are the cards stacked in the stacker?
9. In what sequence are the cards when they have been removed from the stacker?
10. When the main-line switch is turned on, how soon may operations begin?
11. What is the purpose of the column indicator?
12. How may multiple digits be manually punched in one column of a card?
13. The combination keys on the keyboard contain both letters and numbers. How are they distinguished from the other keys on the keyboard?
14. If the keyboard is in numerical shift and a letter key (other than a combination key) is depressed, what happens?
15. What is the purpose of the duplicate key with program control? Without program control?
16. What happens when the -SKIP key is depressed in numerical shift? In alphabetic shift?
17. What does the release key do when depressed?
18. Normally, what is the purpose of the skip key?
19. Define *field*.
20. What is the purpose of the program card?
21. What punch in the program card starts skipping? What punch continues skipping?
22. What punch in the program card starts duplication? What punch continues duplication?
23. What punch in the program card automatically causes alphabetic shifting?
24. How is the program card fastened around the drum?
25. How is the drum inserted in the punch?
26. What is the purpose of the automatic skip and duplicate switch?
27. What is the purpose of the automatic feed switch?
28. When a card is punched on the printing punch, where do the characters print?
29. Explain the procedure for making over a damaged card.
30. Why should punching registrations be checked daily?

THE ARRANGEMENT or sorting of documents into sequence or groups by hand has always been a time-consuming and tedious operation, frequently resulting in errors due to the human element. Likewise, the manual selection of desired documents from a file of records is a slow and inaccurate process.

These functions usually precede the final preparation of reports, the requirements of which may vary considerably. The accuracy and timeliness of these reports is of the utmost importance, because they form the basis for administrative action.

One of the greatest advantages derived from the use of punched-card records lies in the ability to perform these sorting and selecting operations with the aid of a high-speed machine known as a sorter, of which there are two types: Type 80, operating at a speed of 450 cards per minute; Type 82, operating at a speed of 650 cards per minute.

TYPE 80

As may be seen from the illustration (Figure 26), this machine has a card feed hopper located at the upper right-hand corner of the machine. This hopper has a capacity of approximately 800 cards and is the receptacle into which an operator places the cards that are to be sorted.

To the left of the hopper is a glass top under which are 13 compartments or pockets that receive the cards after they have passed through the machine. The pockets are arranged from left to right in the following manner: 9, 8, 7, 6, 5, 4, 3, 2, 1, 0, 11, 12, R. Each pocket corresponds to one of the 12 punching positions in a card column. The R (reject) pocket receives cards that are unpunched in the column being sorted. Cards pass through the machine at the rate of 450

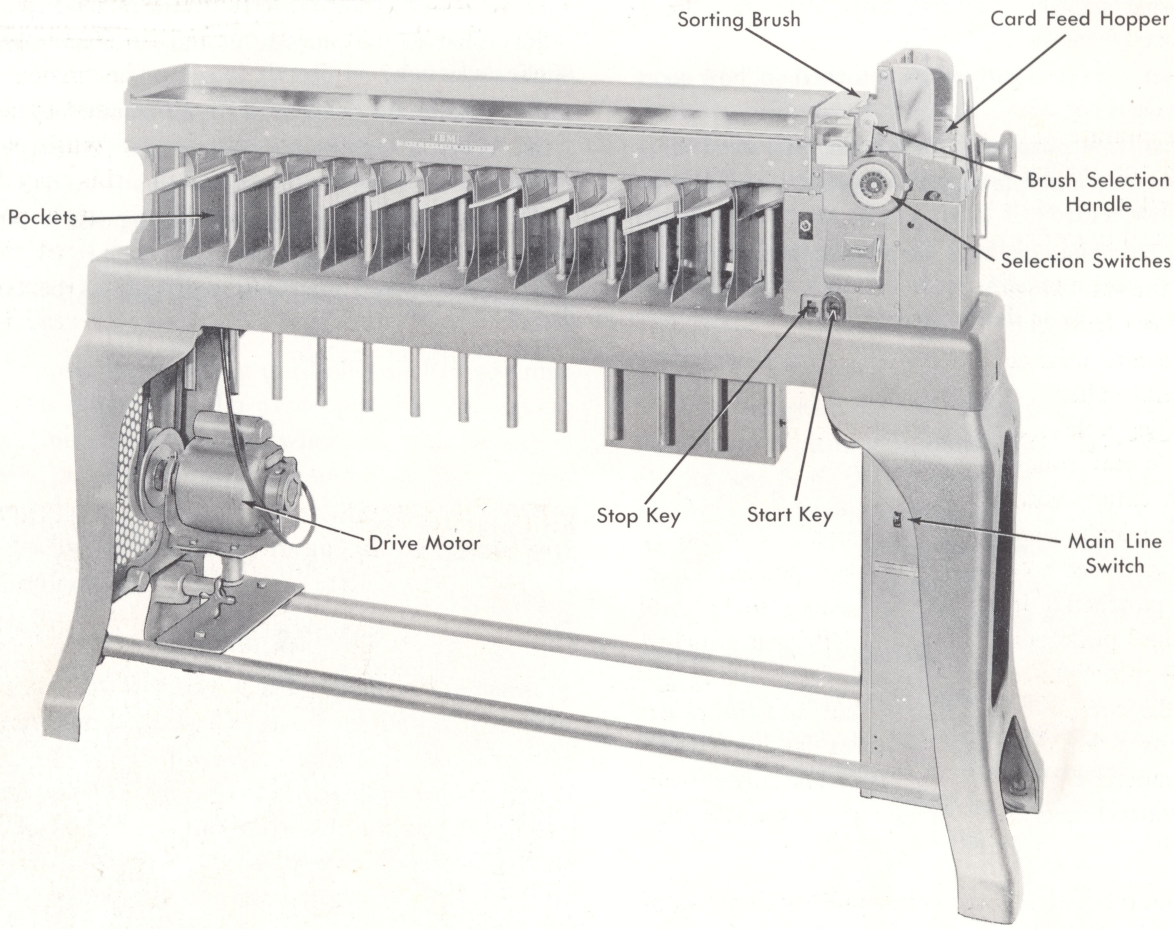


FIGURE 26. TYPE 80 SORTER

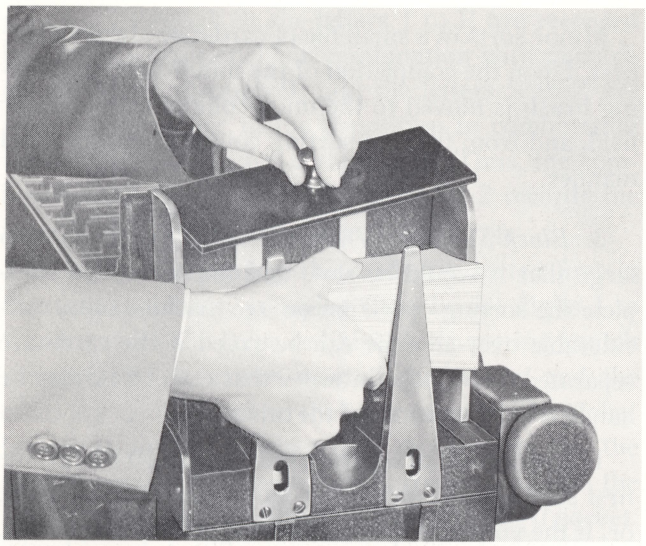


FIGURE 27. CARD FEED HOPPER

cards per minute. The cards are placed in the feed hopper of the machine (Figure 27) face down, 9's (bottom edge) toward the throat. The throat allows only one card to feed at a time.

When the start key is depressed, the cards are automatically fed from the bottom of the stack by a card feed knife and advanced between the sorting brush and a metal roller. As the brush drops through the first punched hole in a given column, contact is made with the metal roller, thereby closing an electrical circuit. A chute blade corresponding to the punched hole is electrically opened, and the card is directed by the chute and feed rolls into the proper pocket. Thus, all cards punched *1* in the column being sorted will fall into the 1 pocket of the machine; all cards punched *2* will fall into the *2* pocket, etc. If no punching appears in the column, the card will fall into the reject pocket. For a double-punched column, as in the case of an alphabetic character, the card will be sorted from the first contact made (punch nearest the bottom edge of the card).

Each pocket of the sorter is equipped with an automatic stop lever, which stops the machine when any pocket has become filled with cards. In order to resume operation, the cards must be removed and the start key depressed.

OPERATING FEATURES

Main-Line Switch

The main-line switch located on the right lower part of the machine must be turned on to supply current to the machine.

Start and Stop Keys

Two keys will be found to the right of the pockets. The covered key is the start key and must be depressed in order to start the feeding of the cards from the hopper. Once started, the feeding of the cards is automatic as long as cards remain in the hopper. The uncovered key is the stop key and must be depressed when the machine is to be stopped.

Sorting Brush and Selection Handle

The actual sorting of each card is performed by a sorting brush (Figure 28), which is mounted on a holder directly to the left of the card feed hopper. A brush selection handle, which may be turned clockwise or counterclockwise, makes it easy to set the brush on any desired column. If the brush is to be moved across a number of columns, this may be accomplished by raising the handle to the upper position and moving the brush holder to the desired column, while pressing down the finger lever on the top of the brush holder. Only one column can be read by the sorting brush at one time.

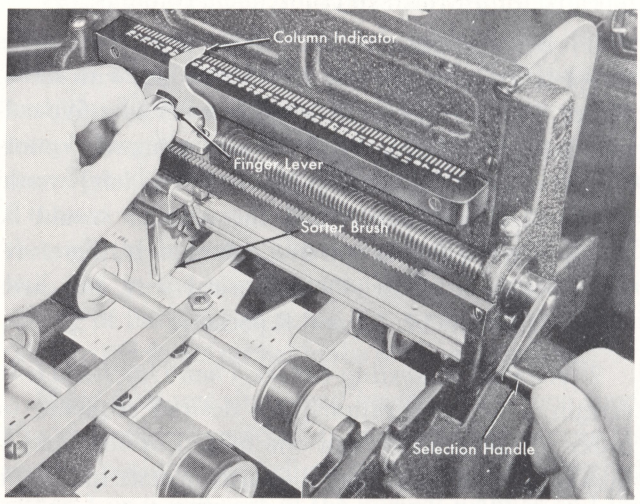


FIGURE 28. COLUMN INDICATOR

MACHINE FUNCTIONS

1. *Numerical Sorting (One Field).* Each vertical column in a field requires a *sort,* or, in other words, the cards must pass through the machine once for each column of numerical information to be sorted. For example, where cards are to be sorted by a department number that is punched in a two-column field, the right-hand or units column must be sorted first. Cards sorted in the 0 pocket will contain all department numbers ending in zero; i.e., department numbers 10, 50, 40, 30, 90, etc. Cards sorted in the 1 pocket will contain all department numbers ending in 1, for example, department numbers 21, 31, 61, 01, 91, 81, etc. Other cards will fall in their respective pockets. The cards are removed from the sorter pockets and placed in ascending numerical sequence so that the zeros will be first, followed by 1, 2, 3, etc.

To complete the numerical arrangement, the sorting brush must be reset on the tens column (the next column to the left), and the cards are sorted a second time. Zeros on the previous sort must be fed through the machine first, followed by the 1's, then the 2's, etc. On the second run, cards sorted in the 0 pocket will contain department numbers 01 to 09; cards sorted in the 1 pocket will contain department numbers 10 to 19; cards sorted in the 2 pocket will contain department numbers 20 to 29, and so on. If the cards are stacked in ascending order after the completion of the second sort, the cards become arranged in numerical sequence from department number 01 to department number 99.

For sorting larger fields, this procedure must be repeated for the third and subsequent columns.

It is usual practice to punch all numerical card fields completely; i.e., to precede significant data with zeros. Hence, in recording a two-digit number in a five-column field, the fifth, fourth and third columns (counting the columns in the field from right to left) would be punched with zeros, and the number would be punched in the second and first columns. It, therefore, follows that in a strictly numerical sort, no cards should fall in the 11, 12, and R pockets.

2. *Numerical Sorting (More Than One Field).* In certain sorting operations, the desired sequence or order involves more than one field. For instance, it may be desired to arrange the cards in state order and in county order within each state. This is known as a major and minor sort. Because a county is a subdivision of a state, the county field is considered the minor sort, and the state field the major sort.

Minor sorts in a small file of cards are always made first. Upon the completion of the minor sort, the sorting brush is moved to the units column of the major field, and from then on sorting continues in the usual manner.

3. *Block Sorting.* Where the volume of cards is so large that it would be slow and impractical to complete the sorting operation on one machine only, considerable over-all time can be saved if the cards are separated into blocks in order that each block may be handled independently of the others.

If it is desired to separate the file into 10 blocks, the first sort is made on the left-hand column of the field, or, if the volume requires subdivision into 100 blocks, each of the ten blocks can be further divided by sorting on the next column to the right. Several machines can be used simultaneously in breaking down the file. From this point on, each block is handled as a separate group, sorting from the units column of the field through all unsorted columns to the left.

While this is contrary to statements previously made with respect to regular sorting procedure, it offers advantages which should not be overlooked. Block sorting permits the use of more than one sorter, not only in the creation of the blocks but in the final sorting as well.

In operations involving more than one field, blocking may be accomplished by first sorting the major field. Each major group can then be treated as a separate unit of the file. In block sorting, as in any other sorting operation, cards must be sight-checked as they are removed from each pocket of the machine.

Another advantage gained in block sorting lies in the fact that any error that may have occurred is localized to a particular block, and is easier to correct than if spread through the entire file.

Block sorting is also frequently desirable when handling files of any size, because it permits the processing of completed blocks through other machines while remaining blocks are still being sorted.

4. *Alphabetic Sorting.* Alphabetic sorting requires two sorts on each column to be arranged, because a letter is recorded by two holes punched in a single column.

The letters A to I are recorded by a hole in position 12 of the column in combination with numerical punches 1 through 9; the letters J to R are recorded by a hole in position 11 in combination with numerical punches 1 through 9; and the letters S to Z are recorded by a hole in the 0 position in combination with numerical punches 2 through 9. Thus, the combination 12-1 records the letter A; 12-2 records the letter B; 11-1 records the letter J, and so on.

In alphabetic sorting, the cards are sorted first in the normal manner, grouping them by the digits 1 to 9, after which the large red alphabetic sorting switch (Figure 29) is moved toward the center, and the cards are again sorted on the same column. The alphabetic sorting switch when thus moved cuts out the normal circuits 1 through 9, and, consequently, in the second run, all cards will fall in the 12, 11 or 0 pocket. The 12 pocket will contain cards punched with the letters A through I; the 11 pocket those with J through R; and the 0 pocket those with S through Z, all in alphabetic sequence.

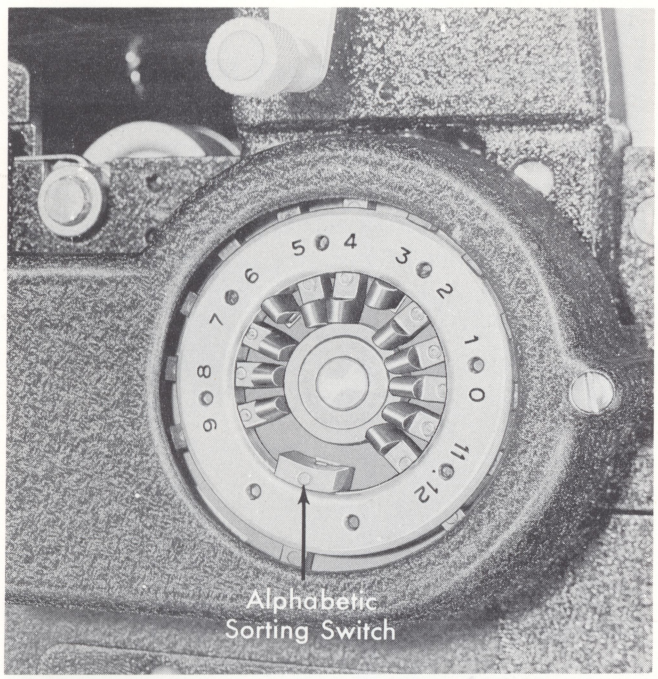


FIGURE 29. SELECTOR SWITCHES

It must be remembered that in all normal sequence sorting operations, alphabetic or numerical, the sorting must start in the first or right-hand column of a field and progress to the left until all columns are sorted. Also all cards must be sight-checked when removed from each pocket of the machine.

Because alphabetic punching can involve word descriptions with spaces between words, the unpunched columns caused by spacing will sort in the reject pocket on the first run. It is not necessary to sort the rejected cards through the machine a second time. However, at the completion of the second sort, they must be placed in front of the file before proceeding with the next column.

What has been said regarding block sorting of numerical fields applies equally to alphabetic fields. Large files of cards may be sorted alphabetically on any given column of a field, after which each letter (or block) will be handled as separate units of the file.

5. *Single Column Selection.* It is sometimes desirable to select cards punched with a certain digit from a file of cards without disturbing the original sequence. This may be accomplished by the use of the commutator, which is located just below, and to the left of, the feed hopper. This commutator (Figure 29), or selection device, is equipped with twelve small black switches, one for each pocket of the machine, not including the reject pocket.

In normal sorting operations, these switches should be set to the outer edge, that is, toward the numbers that may be seen on the rim of the commutator. When the switches are pushed toward the center, corresponding impulses will be ignored by the machine, and the cards will be treated as blanks and therefore rejected.

This feature can be utilized to perform certain limited selection operations. For example, it may be desired to select from a file of cards all cards punched with the digit 6 in column 36. The procedure for accomplishing this is as follows: Set the brush on column 36 and push all selection switches except number 6 toward the center of the commutator. As cards pass through the machine, those punched 6 in column 36 will sort in the normal manner, but because of the setting of the other switches, the rest of the cards will fall into the reject pocket in the original sequence.

More than one digit may be selected at one time. For example, if switch 3 is allowed to remain in its normal position, as well as switch 6, cards punched either 3 or 6 will sort in the normal manner and the rest of the cards will be rejected.

In some cases, it may be desired to segregate the selected cards without disturbing their original sequence, and without regard to the arrangement of the remainder of the file. In this case, the reverse principle will be followed. Switches 3 and 6 will be pushed to the center of the commutator, all other switches remaining in their normal position. In this operation, cards punched either 3 or 6 will fall into the reject pocket, in their original sequence, and cards punched with other digits will sort normally.

All 1 to 9 impulses are ignored when the alphabetic sorting switch is moved toward the center. The effect is the same as would be obtained by pushing in the commutator switches for positions 1 to 9. For numerical selection as outlined in the preceding paragraphs, the alphabetic sorting switch should be set in its normal position.

6. *Total Card Count.* A special electrically operated card counter (Figure 30), which registers 1 for each card passing the brush, may be connected to the sorter. It is mounted so that the dials are in a position for easy reading and manual transcribing of totals. The counter does not affect the normal speed or method of operation of the machine to which it is attached. The maximum capacity of the device is 99,999. This mechanism counts only the total number of cards passing through the machine.

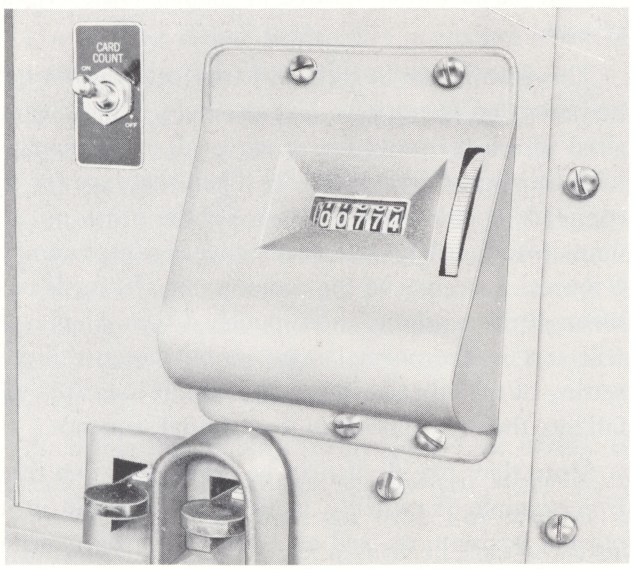


FIGURE 30. TOTAL CARD COUNTER

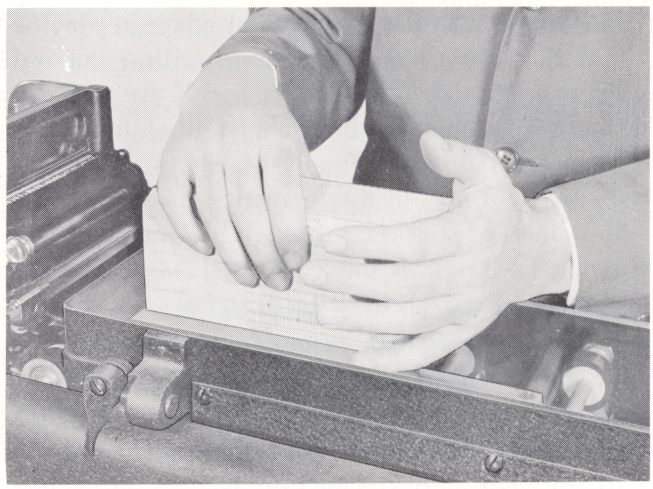


FIGURE 31. JOGGLING CARDS

The operation of this device is controlled by a card count switch. If card counting is not desired, the switch should be thrown off. To clear the total in the counter, the reset wheel to the right of the counter must be turned downward until all counter wheels read zero.

CHECKING AND STACKING SORTED CARDS

Sight-Checking. As the cards are removed from the pockets, the sorting must be checked. This is accomplished by joggling the cards (Figure 31) removed from each pocket into perfect alignment, then holding the cards in front of a source of light and looking through the hole corresponding to the pocket from which they were removed. If the cards have been properly sorted, the holes (punched the same in the position being checked) create a tunnel through which

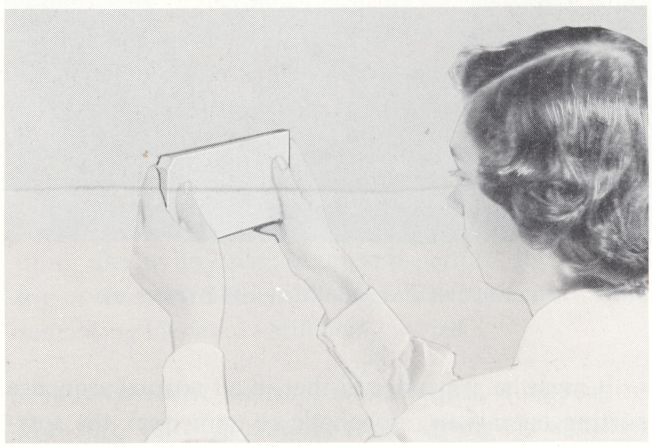


FIGURE 32. SIGHT CHECKING

light may be seen (Figure 32). If the digit in question is not punched in any card of the group being checked, it is impossible to sight-check the position. This indicates that one or more cards have been missorted. These must be located, removed, and hand-filed in their proper places. In hand-filing, consideration should be given to any columns previously sorted, as well as the column just completed.

This operation is known as *sight-checking* and must be performed as each group of cards is removed from any pocket of the machine.

Use of the Sorting Needle. The location of missorted cards can be facilitated by the use of a sorting needle as illustrated in Figure 33. The missorted card blocks the needle and may be readily removed.

Another use of the sorting needle is the manual sorting of comparatively large groups of cards having the same punching in a given column.

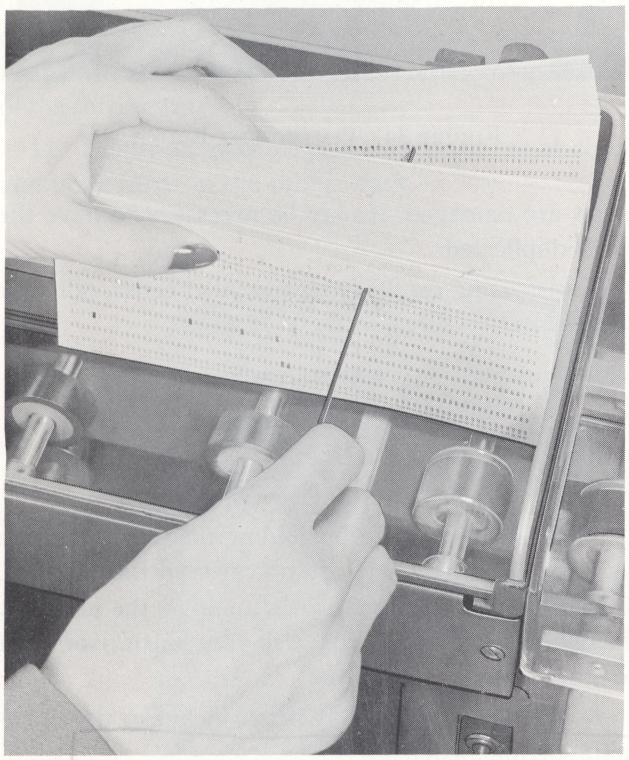


FIGURE 33. USE OF SORTING NEEDLE

Temporary Stacking of Cards. Following the sight-checking of each group of cards, they are stacked face down in sorter trays usually attached to the back of the machine. In the absence of sorter trays, a working table with file drawers or boxes should be located conveniently near the machine.

If the volume of cards to be sorted is small (2,000 or less), the glass top of the machine may be used for temporary stacking of cards.

In removing cards from the temporary stackers for subsequent sorting, cards must be fed into the hopper from the bottom of each stack, or from the front of a file drawer. If this is not done, previous sequence is destroyed.

OPERATING POINTERS

EFFICIENT sorting machine operators rarely need supervision or require assistance because they know the steps necessary to carry an operation to its completion.

Most of the difficulty that occurs in a sorting operation can be traced to improper handling of cards. Edges of the cards are sometimes damaged in joggling or in placing them in the feed hopper. This often causes a jam as they pass through the machine. Cards may wrinkle or fold at the throat, under the brush, or between the chute blades and rollers of the machine, causing a jam. What should you do as an operator to reduce this possibility to a minimum?

First of all, you should always check the edges of the cards to be sure that none are bent or torn. Check the feed hopper to be certain that it contains no dirt, card dust, pieces of paper, or other obstruction that might clog the throat.

Always "fan" cards before putting them in the feed hopper. This will remove static electricity, which causes cards to stick together, particularly in damp weather. Fanning also allows any foreign material that may be between the cards to drop out.

Watch the sorting carefully to see that cards do not stand vertically in the pockets. Any cards falling vertically must be straightened immediately, otherwise they may get out of sequence or cause a jam as other cards feed into the pocket.

In the event of a jam, the first thing an operator should do is stop the machine by pressing the stop key and turning off the main-line switch. If the jam has occurred at the throat, empty the hopper and raise the brush from the roller by turning the brush handle a half turn; i.e., until the handle is in the upper position. Remove the brush holder to prevent damage to the brush while cards are being removed. If part of the jam is between the chute blades, raise the glass top of the machine by lifting the front.

In removing jammed cards from the machine, make every effort to straighten the cards enough so that they may be run into the pockets by turning the hand feed wheel on the right end of the machine. If the jam is too severe, it may be necessary to tear the cards under the blades in order to get the pieces out of the machine. In doing this, pull from one side of the chute blades, exerting steady pressure on one end of the card. Be careful not to pull the chute blades out of line while removing the cards. Make every effort not to tear damaged cards any more than necessary, because this makes it more difficult to assemble the pieces in order to punch duplicate cards, which have to be hand filed in their proper sequence.

When all damaged cards have been removed from the machine, close the top and replace the brush holder. Always check to be sure that the wire strands of the brush are not spread or damaged.

If it is necessary to replace the brush, check to see that it is adjusted to the proper sorting position. Electrical timing may be affected if this precaution is not taken.

Timing the brush is a simple operation if it is done in the following manner (Figure 34) :

1. Turn on the main-line switch.
2. Set the brush on any column.
3. Punch a card with an 8 in the column on which the brush is set, and place it in the feed hopper with the card weight.
4. Turn the hand feed wheel so that the card is slowly advanced into the machine until contact is made by the brush through the hole.
5. When contact is made, a click will be heard that is caused by the dropping armature plate. The card edge should be approximately 1/32" under the end of the first chute blade. You may now depress the start key. The card should always fall into the 8 pocket. If it does not, the brush has not been properly timed. Ask the supervisor to adjust the brush for you.

Make every effort to keep the machine clean, because dirt and other foreign material may cause the machine to jam.

Missorting is sometimes caused when punched holes are off-gage or when the bottom edge of the card, which passes through the throat, is slightly damaged. If cards appear to be off-punched, have your supervisor check several of them with a card gage. If edges are damaged, it may be necessary to have the cards duplicated.

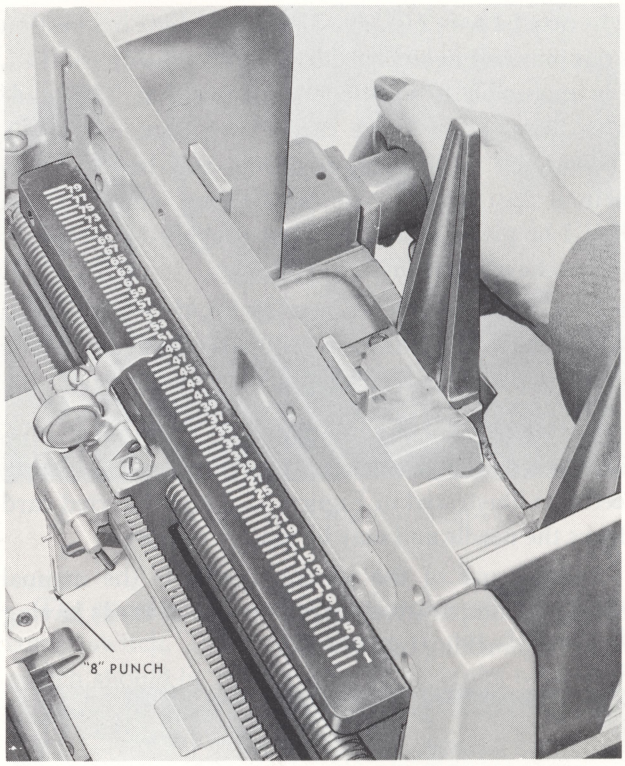


FIGURE 34. TIMING THE BRUSH

If missorting results from any other cause, call your supervisor.

HOW TO OPERATE A SORTER

1. Plug the cord to a source of current.
2. Turn on the main-line switch.
3. Clear the machine by holding the start key down to make sure that there are no cards in the machine. Do not throw away any cards found in the machine. They may be good records. Ask your supervisor what to do with cards found.
4. Check the selection switches including the alphabetic sorting switch.
5. Determine the exact sequence to be followed. *If you are not sure, ask your supervisor.*
6. Set the brush on the column to be sorted. Cards must go through the machine as many times as there are columns to sort, or more, because alphabetic sorting requires two runs through the machine per column. In a normal sorting operation not involving too large a volume, start sorting on the units column.

7. Joggle a handful of cards until edges are in perfect alignment, then place the cards in the feed hopper, face down, 9's or bottom edge toward the throat. *Do not drop* or force cards into the feed hopper. If you do, the feed knives may damage the edges of the cards.

8. Do not put too many cards in the hopper, because too much weight on the bottom card puts extra strain on the feed knives and may cause failure in feeding. A good operating load is when the hopper is not quite full. Always place the pressure plate on top of the cards.

9. Press the start key until automatic feeding starts. Reload the hopper before it is empty, to avoid stopping the machine.

10. If the machine stops, check the pockets to see if any are full. The stop lever in the bottom of the pocket will stop the machine if the pocket fills. If the pocket is full, remove the cards and press the start key to restart the machine. Joggle the cards and sight-check to be sure none of them have missorted, and place the cards face down in the proper compartment of the sorting tray.

11. Empty all machine pockets; joggle, sight-check and place cards in the proper rack.

12. Move the sorting brush to the next column to the left and repeat the operation, feeding 0's into the machine first, followed by other digit groups in numerical order, ending with the 9's.

13. In removing cards from sorting trays, be certain to feed them into the hopper from the bottom of each compartment. *If this is not done, previous sequence is destroyed.*

14. Repeat the procedure for all other columns of the field.

15. File the cards according to instructions from the supervisor.

TYPE 82

THE MAIN differences between the Type 82 Sorter (Figure 35) and the Type 80 are as follows:

Speed. The Type 82 operates at 650 cards per minute.

Appearance. The Type 82 is more streamlined. The main-line switch, start and stop buttons are located in positions as shown in Figure 36.

Warm Up. After the main-line switch is turned on, a 60-second waiting period is required before the ma-

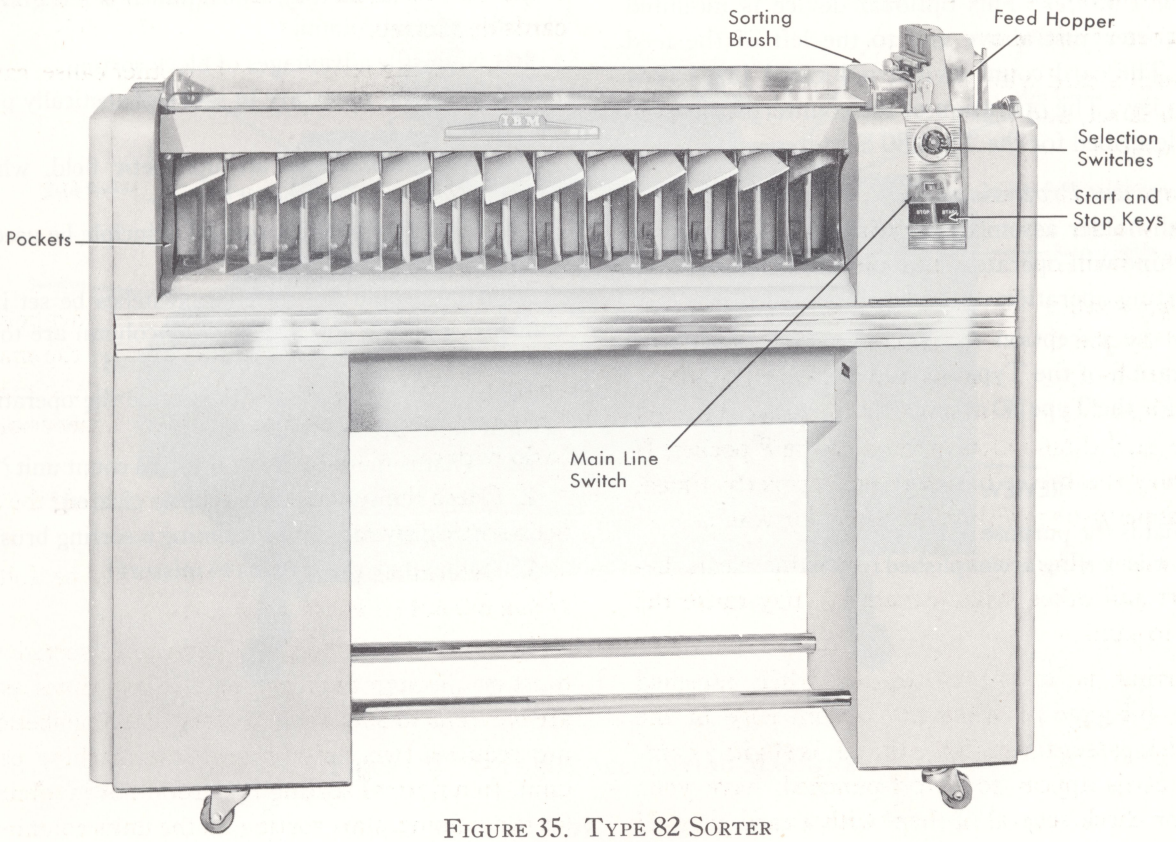


FIGURE 35. TYPE 82 SORTER

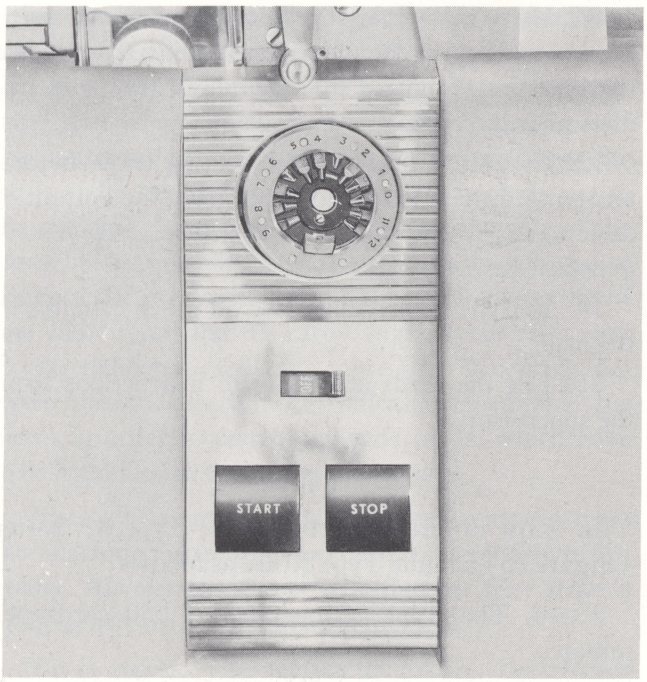


FIGURE 36. SELECTION SWITCHES, MAIN-LINE SWITCH AND START AND STOP KEYS

chine will operate. This is necessary to allow time for the electronic tubes to warm up.

Visible Counter. This optional device is mounted on the sorter just above and to the left of the feed hopper. The card count switch is located just below the start key. The operation of the counter is identical to that described for the Type 80 Sorter.

Transparent Protecting Cover. This cover fits over the brush holder assembly and must be closed before the machine will operate. It should not be raised during a sorting operation or the machine will stop.

With the exception of the foregoing differences, the operation of the Type 82 is identical with that explained for the Type 80 on preceding pages.

REVIEW QUESTIONS

1. What is the purpose of the sorter?
2. How is sorting accomplished?
3. How many pockets are there and what is the purpose of each one?
4. How are the cards placed into the hopper?
5. What directs the cards into the pocket?
6. What is the purpose of joggling cards before placing them in the sorter?
7. Why must the cards be sight-checked after removing them from the sorter pockets?
8. How is the brush changed from column 15 to column 79?
9. If a card missorts on any sort after the first one, what factors must be taken into consideration before hand filing?
10. When one column of a field has been sorted, the cards from which pocket should go into the machine first on the next sort?
11. Why is it possible to locate missorted cards with a needle?
12. Name two reasons why the sorter will stop automatically.
13. Where should cards be stacked temporarily between sorts when sorting small groups of cards? When sorting a large group of cards?
14. If cards are to be sorted on man number, punched in columns 13 through 18, what column would normally be sorted first?
15. In normal sorting, which punch is recognized in a double-punched column?
16. Name the advantages of block sorting.
17. Why is it necessary to sort alphabetically punched columns twice?
18. When sorting on an alphabetic field, why may cards fall in the reject pocket?
19. How can the block sorting principle be used when sorting alphabetically?
20. How would the selection switches be set if cards punched with a 2 and 5 in a given column are to be rejected and all other cards are to be sorted?
21. When is it necessary to reverse the operation described in the preceding question?
22. What is the capacity of the card count unit?
23. How is the total in the counter cleared?
24. Explain procedure for timing a sorting brush.
25. What may cause cards to missort?

MANAGEMENT must be kept constantly informed by reliable up-to-date information regarding material, sales, inventory, payroll, production, etc., if it is to operate at top efficiency. This information is prepared for management in the form of reports and analyses that become the basis of administrative action.

Many computations must be made, checked, and summarized before the data can be presented in report form. Because of the length of time required, manual methods often fall far short of meeting management requirements.

When the basic information is contained in IBM cards, management reports can be prepared with speed and accuracy. The IBM accounting principle consists of three basic steps:

1. Information written on source documents is transcribed to IBM cards.

2. The punched cards are arranged by the sorter in the sequence desired.

3. Printed reports are prepared automatically by accounting machines that read the holes in the cards and print the reports.

Several types of IBM accounting machines are available, only five of which are covered in this manual, namely, Types 405, 416, 402, 403, and 407.

TYPE 405

The Type 405 Accounting Machine (Figure 37) is a combined adding, subtracting, and printing machine. Punched cards passing through this machine actuate various counters and printing mechanisms. This machine is so designed that it provides complete flexibility in the arrangement of the compiled and printed data on the report form. The machine is entirely automatic and operates at a maximum speed of 150 cards per minute. A summary punch machine may be attached for the automatic production of summary or total cards simultaneously with the preparation of the printed report.

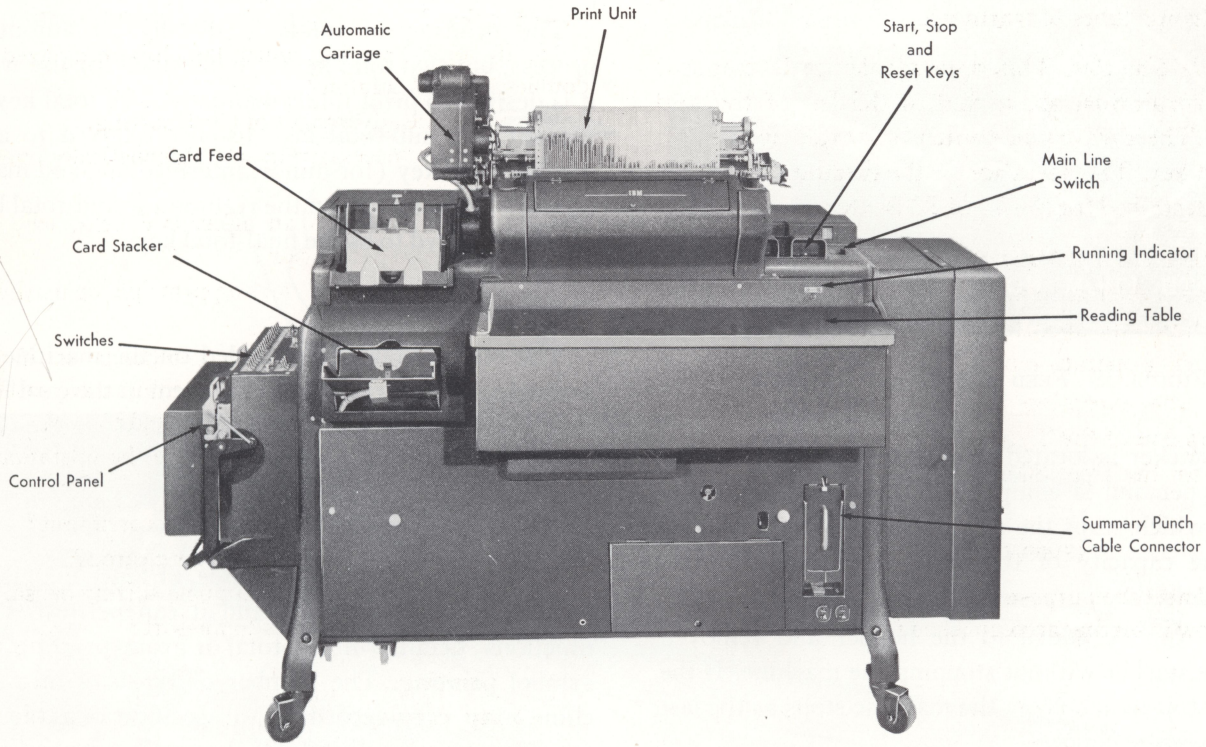


FIGURE 37. TYPE 405 ACCOUNTING MACHINE

OPERATING FEATURES

Control Panel

This is the "brain" of the machine, and it controls reading of information from the card and printing of this information in the proper place on the report form. It is inserted in the rack provided for it on the left side of the machine.

Feed Hopper and Stacker

The card feed hopper (Figure 38) is located at the left end of the machine. Cards must be placed in the hopper face down with the 9's toward the throat. The hopper holds from 800 to 900 cards, and as soon as the last card is read, the machine stops automatically. Three cards remain in the machine upon completion of an operation, and they must be run into the stacker by depressing the start key.

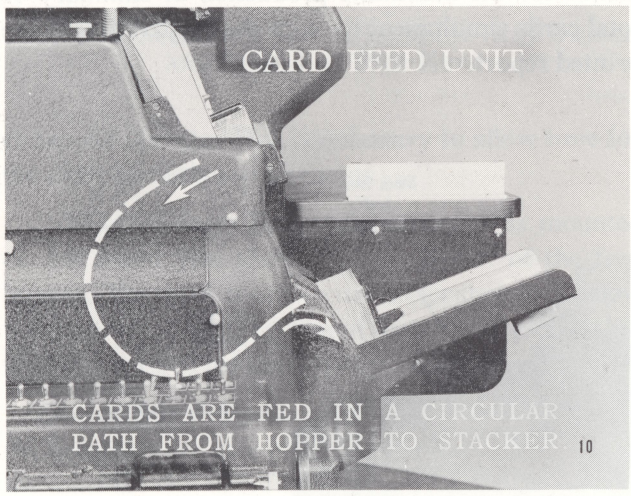


FIGURE 38. FEED HOPPER AND STACKER

The stacker is located immediately below the card feed hopper and is equipped with an automatic-stop switch, which stops the machine when the stacker is full. The capacity of the stacker is approximately 1,000 cards.

Cards can be added to the hopper and removed from the stacker without stopping the machine. If the hopper-stop switch is on, the machine stops as the last card leaves the hopper.

Main-Line Switch

The main-line switch (Figure 39), located at the right end of the machine, must be turned on to supply

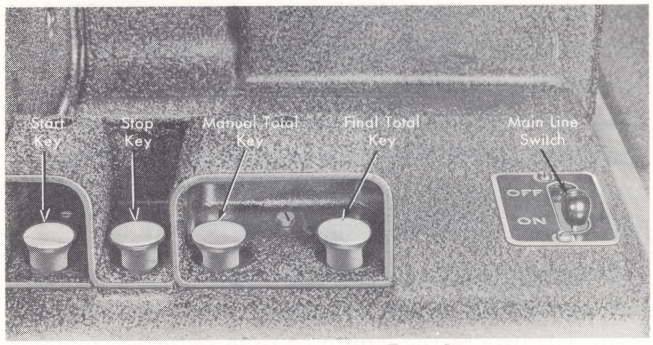


FIGURE 39. CONTROL KEYS

current to the machine. This switch should not be turned off while cards are feeding, or during any other machine operation.

Control Keys

Immediately to the left of the main-line switch are four control keys (Figure 39): start key (covered), stop key (uncovered), and two total keys (covered).

The start key must be depressed to start card feeding through the machine. The stop key must be depressed to stop feeding the cards.

The printing of totals is usually an automatic process, but two total keys are provided for use when it is desired to print totals manually. The total key on the left is a sub-total key, usually referred to as a manual-total key (for minor, intermediate, and major totals). The total key on the right is a grand-total key, usually referred to as the final-total key.

Reading Table

The reading table is provided on the machine for arranging cards prior to placing them in the card feed. It also serves as a small working area while the operator is at the machine.

Print Unit

The print unit of the machine (Figure 40) is referred to as the typebars, and it can perform three functions: detail printing, total or group printing, and symbol printing. The number of typebars in a machine may vary according to specifications, but the maximum number is 88. Of these, 43 can print both alphabetic and numerical information and are called alphamerical typebars; 45 of the typebars can print only numerical information and are called numerical typebars.

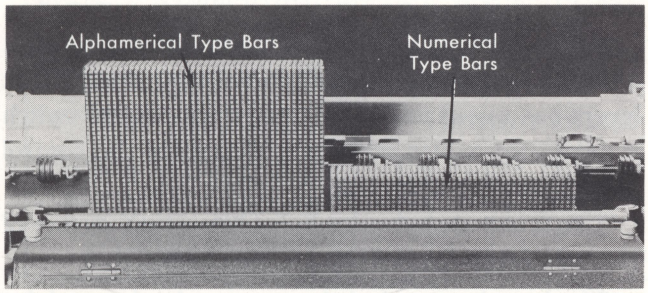


FIGURE 40. PRINT UNIT

The alphamerical typebars are to the left, and the numerical typebars are to the right. The two sections are separated by a space equivalent to one typebar. Each alphamerical typebar consists of 26 alphabetic characters, numerical characters 0 to 9, and a symbol position. A numerical typebar consists of the 10 numerical characters 0 to 9 and a symbol position. The odd-numbered numerical typebars have an asterisk, and the even-numbered bars have a credit symbol (CR).

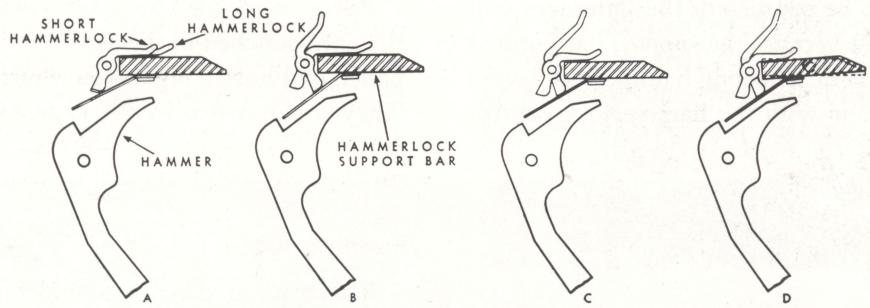
The typebars can be impulsed to print information punched in a card during a detail print cycle and to print totals during a total cycle.

A ribbon, similar to that used on typewriters, moves behind the typebars from a spool on the right to a spool on the left. When the right spool is completely unwound, the action is automatically reversed.

A lever is provided for setting the carriage for either single, double or triple spacing. Single spacing is six lines to an inch; double spacing, three lines to an inch; triple spacing, two lines to an inch. Numerical information can be printed from either the alphamerical or the numerical typebars. The typebars selected are determined by the position on the report where the information is to be printed. The alphamerical typebars will print to the left of the numerical typebars, and alphabetical information can be printed only from alphamerical typebars.

Hammerlock Levers

Each typebar in the machine is equipped with two types of hammerlock levers (Figure 41): a short lever that is on the right, and a long lever that is on the left. When both levers are down (Figure 41A), the hammer will hit the typebar on every printing cycle, and printing from that typebar will take place normally. When the short hammerlock lever is raised



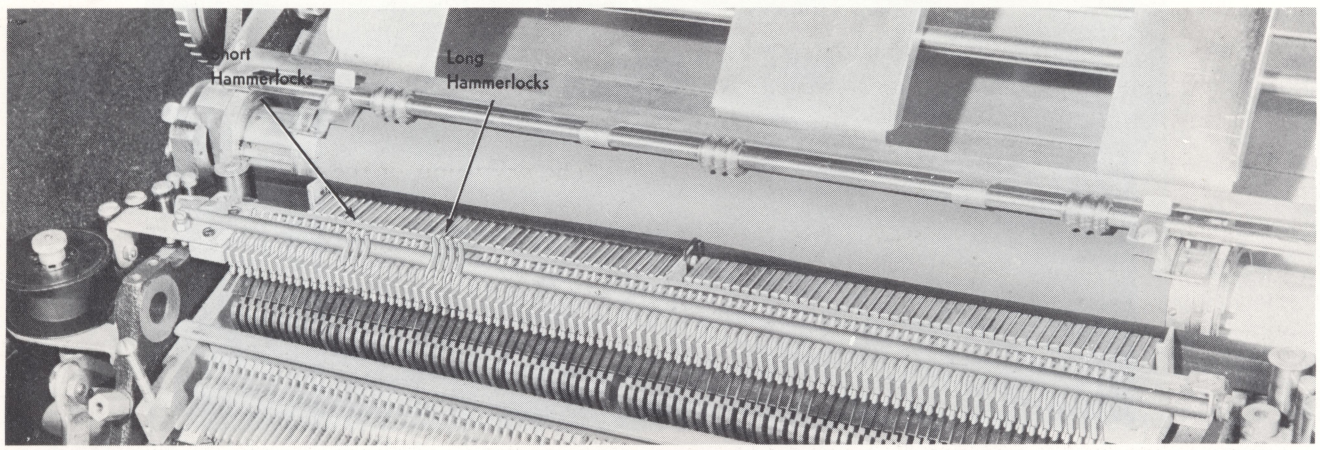


FIGURE 41. HAMMERLOCK LEVERS

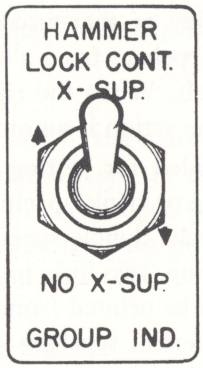


FIGURE 42. HAMMERLOCK SWITCH

(Figure 41B), the hammer will not hit the typebar; therefore, no printing will take place from that typebar.

The long hammerlock levers have one general function: to suppress the printing of all or any part of the information on particular cards on detail print cycles. This is accomplished by setting the hammerlock control switch on X-SUP or NO X-SUP (Figure 42), depending upon the requirements of the report and the wiring of the control panel. When printing is not to be suppressed, the hammers will fire (Figure 41C) because the support bar remains in a normal position. When printing is to be supressed, the hammers will not fire (Figure 41D) because the support bar is tilted just enough to stop them. The long hammerlock levers are used in conjunction with the hammerlock-control switch to prevent overprinting, which occurs when the machine is changed from LIST ON to LIST OFF. This can be accomplished when the long hammerlock levers are raised and the hammerlock-control switch is set to NO X-SUP without a change in the control panel wiring.

Totals will always print regardless of the setting of the long levers.

The long hammerlock levers can also be used for indicating only the first card of minor, intermediate, or major control groups. This function is known as *group indication*. The long hammerlocks, corresponding to the typebars listing indicative information, are raised and the hammerlock control switch is set to NO X-SUP (group indicate).

Hammersplit Levers

Each typebar is also equipped with a hammersplit lever (Figure 43), usually referred to as a zero-suppression lever.

Each lever, when raised, suppresses the printing of zeros to the right of the units digit printing in a column of a report, so that unnecessary zeros in the adjoining column are eliminated.

Zeros on the alphamerical typebars print only when they are punched in the cards, are wired in the control panel, and have a significant digit printing to the left. They are known as *electrical zeros*.

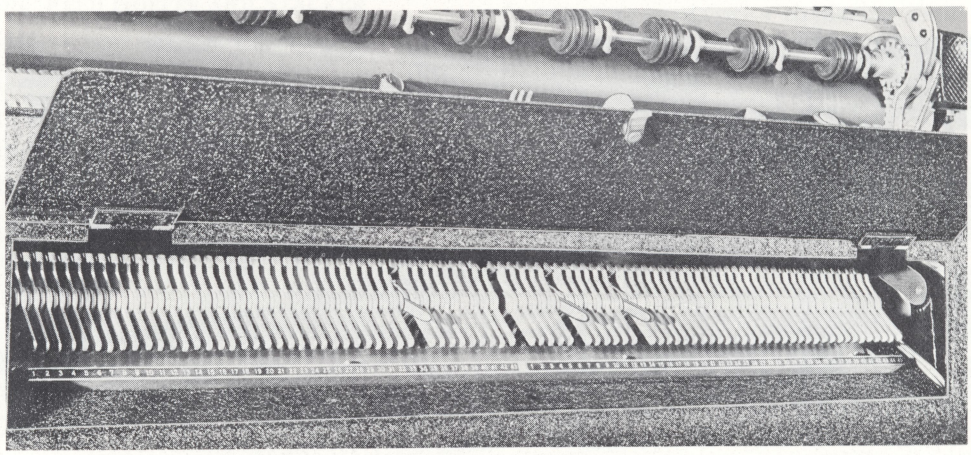


FIGURE 43. HAMMERSPLIT LEVERS

24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
A	B	B	O	T		B	R	O	S		0	1	1	7	9	1	2	3	1				3	1	8	0	0	1	5	8	7	8	0	0	1	5	5	6	0	0	0
A	B	B	O	T		B	R	O	S		0	1	1	7	9	1	2	3	1				1	9	6	0	0	0	9	8	1	3	0	0	0	9	6	1	7	0	0
Hammersplit levers not raised.																																									
A	B	B	O	T		B	R	O	S			1	1	7	9	1	2	3	1				3	1	8			1	5	8	7	8			1	5	5	6	0		
A	B	B	O	T		B	R	O	S			1	1	7	9	1	2	3	1				1	9	6				9	8	1	3				9	6	1	7		
Hammersplit levers 34 alphamerical, and 6, 13 and 20 numerical raised.																																								

FIGURE 44. ZERO PRINTING

The first part of Figure 44 shows printed results without the use of the zero suppression levers.

The second part shows the same results with the proper zero suppression levers raised to suppress the zeros that are not required.

Unwired numerical typebars between the columns of the report form print mechanical zeros to the right of any significant digit.

Switches

The switch panel (Figure 45) is located at the left end of the machine, directly above the control panel. These switches, when properly set, automatically perform certain functions set up by the control panel. A clear understanding of the results to be obtained is essential in determining the proper setting of the switches. The operation of each switch will be explained under *Machine Functions*.

MACHINE FUNCTIONS

THE MACHINE may be set up to perform the following main functions:

1. *Detail Printing.* In this type of operation, information from each card passing through the machine is printed (listed) on the report form. What is printed, and where it is printed, is controlled entirely by the control panel. In a detail printing operation, the three switches at the extreme right of the switch panel must be set to the LIST ON position. When detail printing, the machine operates at the rate of 80 cards per minute.

2. *Group Printing.* In this type of operation, information on each card is automatically accumulated, but is not printed. The only information printed is the indicative data sufficient to identify the group of cards and the totals for each group of cards. What is

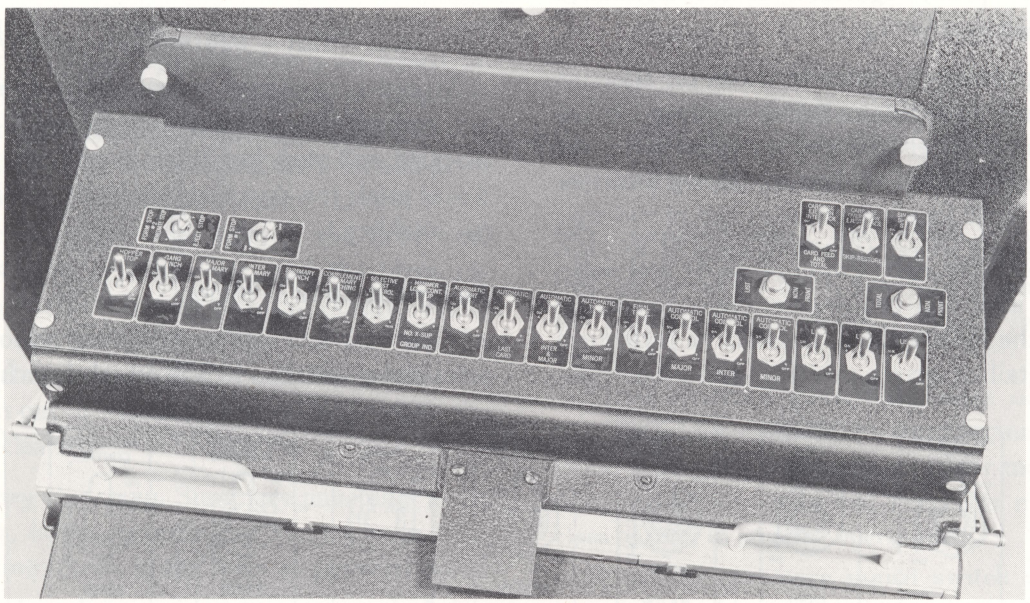


FIGURE 45. SWITCH PANEL

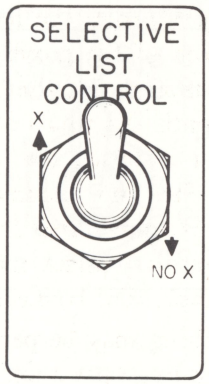


FIGURE 46. SELECTIVE LIST SWITCH

printed and accumulated is controlled entirely by the control panel. In a group printing operation, the three switches at the extreme right of the switch panel must be set to the LIST OFF position. When group printing, the machine operates at the rate of 150 cards per minute.

3. *Selective Listing.* When the accounting machine is wired for group printing, the selective list feature can cause distinctively punched cards to detail print. Selective listing is controlled by a selective-list switch (Figure 46). When the switch is set to X, all X or digit punched cards are detail printed; when set to NO X, all No X or no digit cards are detail printed. When the machine is wired for both automatic control and selective listing, the first card of each control group will also print, regardless of the distinctive punching for selective listing.

In a group printing operation in which the selective list feature is not used, this switch must always be set to the X-position. If set to NO X, the effect would be the same as setting the list switch to the ON position.

4. *Automatic Control and Total Printing.* The printing of totals for each group of cards and automatic starting after total printing are also controlled by switches and the control panel, and may be performed either in a detail or group printing operation. Controls are set up on groups of cards which may have three different classifications: major, intermediate, and minor. For example, if automatic totals are desired by states, counties, and cities, the state groups would be the major groups, the county groups (breakdown of state) would be the intermediate groups, and the city groups (breakdown of county) would be the minor groups. If only one control is desired, it is usually set up on a minor basis.

The switches (Figure 47) must be set according to the specifications of a given report.

Hopper Stop Switch

When this switch is off, it permits the last card to feed through the machine and control totals to print after the last card; when it is on, the last card stops before leaving the hopper so that additional cards can be added without printing totals between groups.

Automatic Start

When this switch is off, the machine will stop after every total cycle, and the start key must be depressed in order to restart the machine. When the switch is on, restarting is automatic.

Automatic Total — Last Card

When this switch is on, totals print automatically after the last card passes through the machine. When it is off, the totals will not print automatically and must be taken by depressing the manual-total key.

Automatic Total — Intermediate and Major

In order to obtain intermediate or major totals automatically, this switch must be on. If it is off, the machine will stop just prior to printing these totals. These totals can then be taken by depressing the manual-total key.

Automatic Total — Minor

This switch must be on before minor totals will print automatically. If it is off, the machine will stop

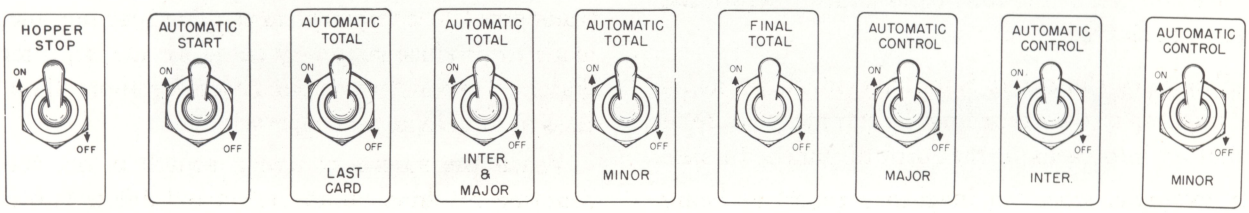


FIGURE 47. SWITCHES

just prior to printing the minor total. The total may be printed by depressing the manual-total key.

Final Total

In order to print a final total, the final-total-reset key must be depressed, and the final-total switch must be on. When this switch is off, final totals cannot be printed.

Automatic Control — Major

This switch must be on to make a major control change effective. When it is off, the machine ignores the major control, even though it may be wired on the control panel.

Automatic Control — Intermediate

This switch must be on to make an intermediate control change effective. When it is off, the machine ignores the intermediate control, even though it may be wired on the control panel.

Automatic Control — Minor

This switch must be on to make a minor control change effective. When it is off, the machine ignores the minor control, even though it may be wired on the control panel.

List and Total Non-Print Buttons

These buttons are used for running cards out of a machine without printing on the form or on the platen. When the list non-print button is depressed, all cards in the feed run out of the machine without listing, automatic controlling, or spacing of the form. If the purpose is to clear the machine, the total non-print button is depressed to reset all counters that are wired to clear, including the final total if the final total switch is ON. The typebars rise, and the form advances a single space, but no printing occurs. When both buttons are used to clear the machine, the list non-print button should be depressed first so that the cards are run out of the feed (and added) before the counters are cleared.

5. *Summary Punching.* Summary punching, as its name implies, is the recording of summary or total information into cards in the form of punched holes.

For example, when an inventory report is being prepared on an accounting machine, it can be set up to show, by each type of product or material, the balance on hand at the first of the month, the receipts and issues during the month, and the balance on hand at the end of the month. As totals are printed by each type of product or material, the information can be automatically punched into summary or total cards. This information is transmitted from the accounting machine to the summary punch machine through the summary punch cable that connect both machines.

Summary punching may be performed either in a detail or group printing operation. All information to be summary punched is controlled by both the control panel in the accounting machine and the control panel in the summary punch.

There are three summary punch switches on the accounting machine (Figure 48). These switches are labelled *Major Summary, Inter Summary* and *Summary Punch.*

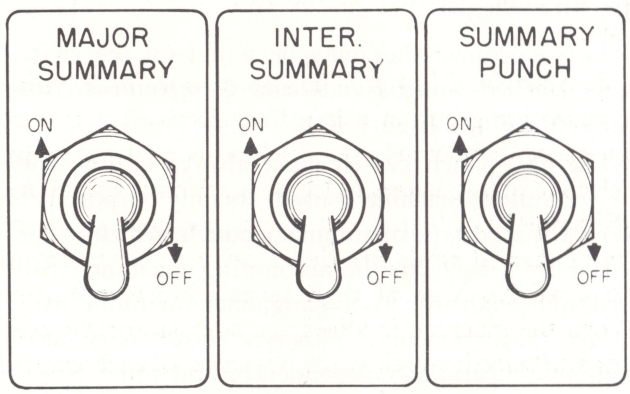


FIGURE 48. SUMMARY PUNCH SWITCHES

The summary punch switch must be on for all summary punch operations. This switch makes both the accounting machine and the summary punch function together as one co-ordinated unit. It also permits the machine to summary punch minor totals. When intermediate or major totals are to be summary punched, the inter- or major-summary-punch switch must be on also.

These switches govern the class of totals to be transferred to summary cards. The machine may be made to produce summary cards for major, intermediate, or minor totals, but never for more than one class of total in any one operation.

When the summary punch switch is on, the accounting machine cannot be started unless two cards are fed from the summary punch feed hopper. The

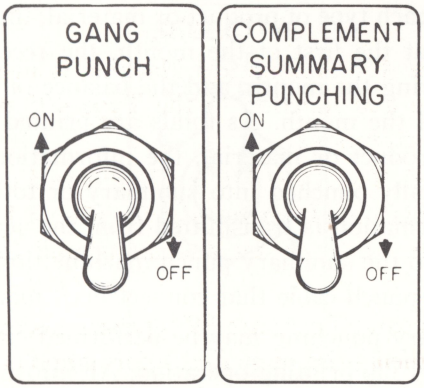


FIGURE 49. SPECIAL SWITCHES

accounting machine stops automatically when the summary punch feed hopper is empty.

If the accounting machine is to be used without the summary punch, these switches must be off.

Special Switches

Two more switches may be found on the switch panel labelled *Gang Punch* and *Complement Summary Punching* (Figure 49).

The gangpunch switch must always be off when the accounting machine is used. Its only purpose is to allow a special type of summary punch, which is connected by a cable to the accounting machine, to be used independently as a gangpunch, without using the accounting machine. This type of summary punch cannot be operated independently and must receive current through the accounting machine. It must be remembered that the accounting machine cannot be operated when the gangpunch switch is on.

The complement-summary-punching switch, when on, will cause the summary punch to punch minus balances in complement figures. To summary punch minus balances in true figures, this switch must be turned off. It should always be set to its OFF position, except upon special instruction from the supervisor.

OPERATING POINTERS

CARDS MUST be joggled and arranged in perfect alignment before placing them in the hopper, face down, 9's toward the throat of the feed.

After the control panel is in the machine, turn on the main-line switch and the final-total switch. Depress the final-total key to clear out any total that may be in the machine. This should be done before the report form is positioned in the carriage.

Always make a short test run to make certain that the report form is properly positioned in the carriage and the switches are properly set. The test should prove that the control panel is properly wired to handle every situation that will occur throughout the operation. This includes the control of the counters and other special conditions indicated on the cards by X's or other types of control punching. The test deck used by the operator is usually made by the person who analyzed the requirements of the report and wired the control panel.

Never attach the connector cable of the summary punch to the accounting machine unless the main-line switches of both machines are off.

When starting an operation, always hold down the start key for at least two card cycles.

Never turn off the main-line switch to stop card feeding. Use the stop key.

Watch the control information occasionally to see that the totals print at the end of each control group. For small groups of four or five items, it is good practice to check the total of the items listed.

Cards may be added to the hopper and removed from the stacker without stopping the machine. However, if there is less than one inch of cards in the hopper at the time of reloading, the machine should be stopped. If this is not done, cards may fail to feed because of the lack of sufficient weight when the card weight is removed.

When handling cards, be careful that cards that have gone through the machine are stacked in the proper containers and kept separate from the cards that are to go into the hopper. Carelessness in handling both groups of cards leads to confusion and inaccurate reports.

Run out the cards by depressing the start key after the report is completed, because the last three cards do not run out to the stacker automatically.

It is not good practice to leave the machine for any long period of time, because each report form going through the carriage should be spot-checked to see that the printing lines up with the columns of the report form. Atmospheric conditions often cause the report forms to expand or contract slightly, and the printing may crowd the vertical lines of a report form. This may be overcome while the machine is in operation by turning the carriage operating handle at the right end of the carriage.

HOW TO OPERATE THE TYPE 405 ACCOUNTING MACHINE

1. Make sure you understand the operation to be performed. If in doubt, ask your supervisor to explain fully.

2. See that the cord is plugged to the proper source of current.

3. Insert the proper control panel in the slide, and clamp it tightly.

4. If summary cards are to be punched:

a. Connect the summary punch cable to the accounting machine, and insert the summary punch control panel.

b. Turn the summarypunch switch on.

c. If cards are to be punched for intermediate totals, turn the inter-summary-punch switch on. If cards are to be punched for major totals, turn the major-summary-punch switch on.

5. Set the necessary switches in accordance with the operation to be performed. If in doubt, have the supervisor set them for you.

6. Turn on the main-line and final-total switches and press the final-total key. If the summary punch is to be used, feed two cards through the summary punch.

7. Insert the proper report form and position it correctly.

8. Joggle the cards before placing them in the hopper, face down with the 9's toward the throat.

9. Make a test run to determine that the switches and the control panel are correct. It is necessary to hold down the start key for at least two card cycles. Any errors in the test run should be brought immediately to the attention of the supervisor. If the test is all right, you are ready to start the operation.

10. Before starting, turn off the final-total switch.

11. Load the hopper (not too full) with cards to be processed, always placing the card weight on top.

12. Store the cards from the stacker in the proper receptacles.

13. Watch the feeding of the report forms from time to time.

14. When the report is finished, turn off the main-line switch, and give the completed report to the supervisor.

15. File the processed cards according to instructions.

TYPE 416

THE TYPE 416 Accounting Machine is identical in appearance and function to the Type 405, with the following exceptions:

1. Speed. The Type 416 is a high-speed numerical printing machine. It operates at the rate of 150 cards per minute, both for detail printing and for group printing.

2. Typebars. There are 89 typebars instead of 88, and all of them print numerical information only.

REVIEW QUESTIONS

1. What is the purpose of the Type 405 Accounting Machine?

2. What other functions besides printing can the machine perform?

3. What is the maximum speed of the machine?

4. Where is the control panel inserted?

5. What happens when the last card leaves the hopper?

6. Is it possible to add cards in the hopper or remove them from the stacker when the machine is running?

7. How many total keys are there, and what is the name of each?

8. What is the function of each of the total keys?

9. What three functions are performed by the print unit?

10. What is the maximum number of typebars on the Type 405 Accounting Machine?

11. How many of the typebars can print both alphabetic and numerical information? Where are they located?

12. How many of the typebars can print numerical information only? Where are they located?

13. What symbol can be printed from the odd-numbered numerical typebars?

14. What symbol can be printed from the even-numbered numerical typebars?

15. When single spacing, how many lines print to the inch?

16. What is the purpose of the short hammerlock levers?

17. What one general function do the long hammerlock levers perform?

18. How many long and how many short hammerlock levers are there?

19. What is the purpose of raising the hammersplit levers?

20. How do zeros print from the alphamerical typebars? From the numerical typebars?

21. If information is printing from numerical typebars 1-9, 17-23, and 32-37, what hammersplit levers must be raised?

22. Explain detail printing. Group printing.

23. Is detail printing faster or slower than group printing?

24. What is your understanding of selective listing?

25. For what three classifications may totals be printed?

26. Which of the three classifications is the smallest? Which is the largest?

27. Name the three automatic control switches, and explain the function of each.

28. A final total is taken by depressing the final-total-reset key. What else is necessary?

29. What is your understanding of summary punching?

30. Besides synchronizing the accounting machine and the summary punch, what other functions does the summary punch switch serve?

31. If cards are placed in the hopper of both the accounting machine and the summary punch, and the accounting machine will not start when the start key is depressed, what is most likely the reason?

32. Can the accounting machine be operated if the gangpunch switch is turned on?

33. How long should the start key be held down when starting an operation?

34. How many cards are left in the machine when the operation is completed?

35. What precaution must be taken before connecting the summary punch cable to the accounting machine?

TYPES 402, 403

LIKE THE Type 405, the Types 402 (Figure 50) and 403 Accounting Machines operate automatically in both feeding of cards and printing of results. The information punched in the card can be read, added, subtracted, compared, or selected, according to the requirements of the report, at a maximum speed of 150 cards per minute. Complete flexibility is provided in the arrangement of the printed data on the report form, and summary cards can be punched simultaneously with the preparation of reports.

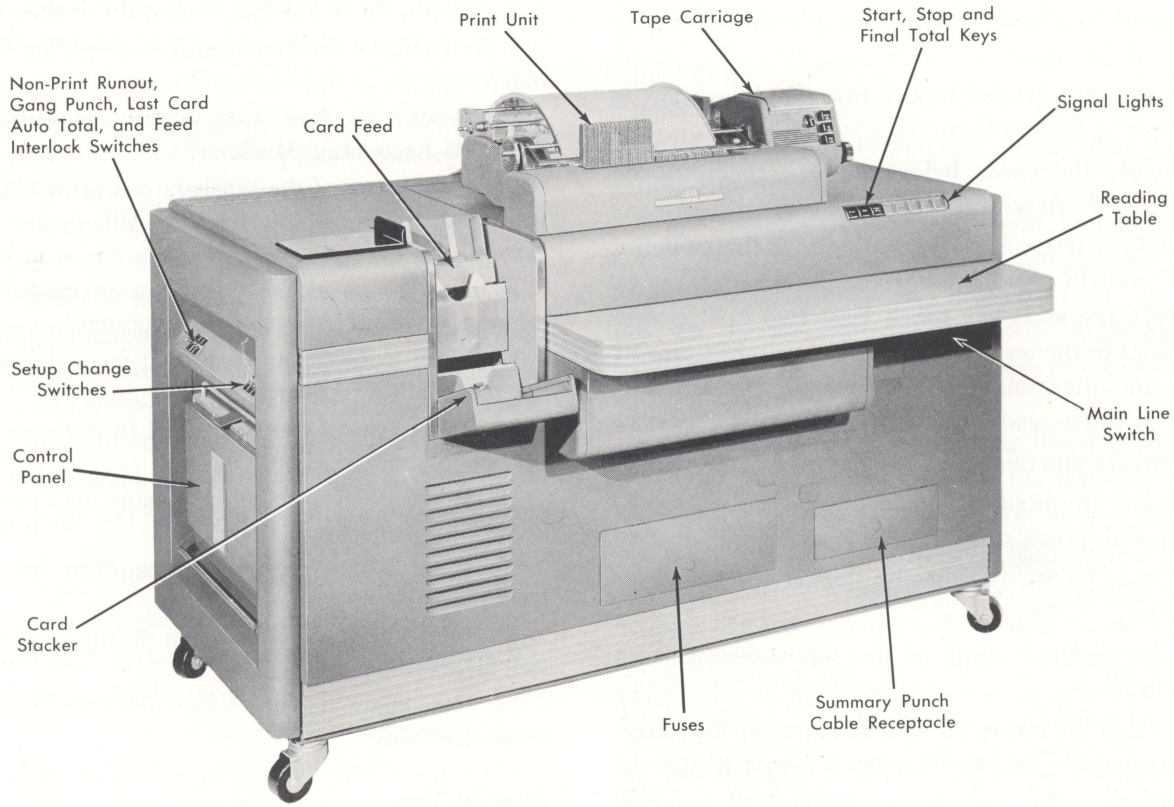


FIGURE 50. TYPE 402 ACCOUNTING MACHINE

The Type 402 and the Type 403 are two distinct and separate machines. They differ only in the number of lines that can be printed from one card. The Type 402 normally prints only one line from a card. The Type 403 can print three lines from a single card, and for this reason, it is called a Multiple-Line-Print (MLP) Machine. In other respects the machines are alike, and the same basic principles of operation apply to both.

Although the operation of the Type 402 and the Type 403 is very similar to that of the Type 405, it will be described separately and completely to avoid reference to the Type 405 section.

OPERATING FEATURES

Control Panel

This is the "brain" of the machine and controls reading of information from the card and printing of this information in the proper place on the report form. It is inserted in the rack provided for it on the left side of the machine.

Feed Hopper and Stacker

The card feed hopper (Figure 51) is located at the left end of the machine. Cards must be placed in the hopper face down with the 9's toward the throat. The hopper holds from 800 to 900 cards; and as soon as the last card is fed, the machine stops automatically. Upon completion of an operation, the cards remaining in the machine must be run into the stacker by depressing the start key.

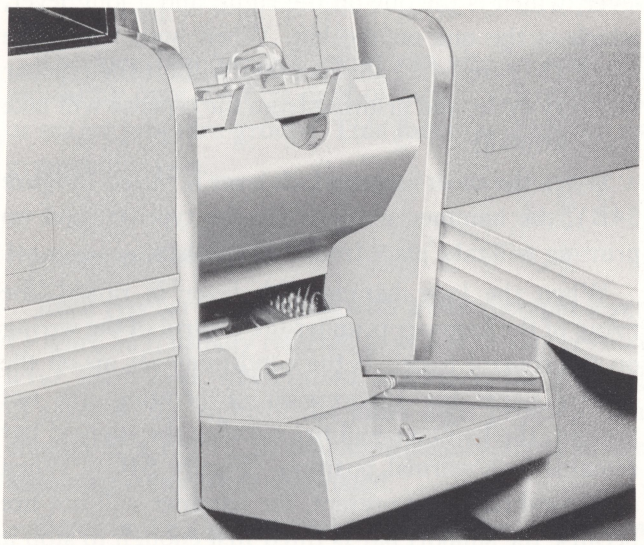


FIGURE 51. FEED HOPPER AND STACKER

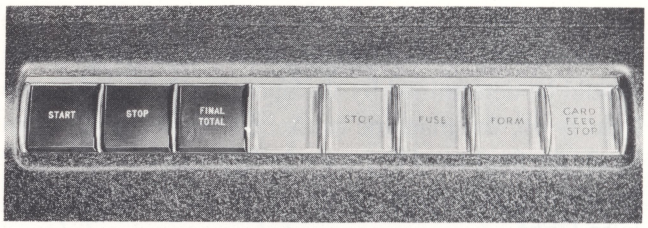


FIGURE 52. OPERATING KEYS AND LIGHTS

The stacker is located immediately below the card feed hopper. When the stacker is full, the machine stops. Its capacity is about 1,000 cards.

Cards can be added to the hopper and removed from the stacker without stopping the machine.

Main-Line Switch

To operate the machine, the main-line switch, located beneath the right end of the reading table, must be turned on.

Start-Stop Keys

These keys (Figure 52) are located on the upper right side of the machine. The start key must be depressed to start feeding cards through the machine. It must also be depressed to resume operation after the machine has stopped for any reason other than feed interlock, as described later.

When the stop key is depressed, the machine will stop before the next card is fed.

Final-Total Key

This key, located to the right of the stop key, provides for manual control over total printing. The following conditions must be satisfied before a final total will print:

1. The machine must be idling.
2. The hopper must be empty.
3. The last card must be in the stacker.
4. The final-total key must be held down while the start key is depressed.

Light (Unlabeled)

The red unlabeled light (Figure 52) will go on when the main-line switch is turned on and the machine is idling.

Stop Light

The red stop light will go on whenever the machine stops because of certain conditions set up on the

control panel. These conditions may vary from one control panel to another; therefore, the conditions should be determined by the operator. While the stop light is on, the machine cannot be restarted. To turn it off, the final-total key must be depressed.

Fuse Light

The red fuse light goes on, and the machine stops whenever a fuse burns out. The fuses are located toward the bottom of the machine below the reading table.

Form Light

The red form light goes on and the machine stops whenever the last form is within 10 inches of the platen.

Card Feed Stop Light

The card feed stop light goes on whenever a summary punch operation is started by the accounting machine. It will remain on and prevent further operation of the accounting machine if for any reason the summary punch operation is not satisfactorily completed. This light also goes on if a card fails to feed from the hopper of either the accounting machine or the summary punch.

Print Unit

The function of the print unit (Figure 53) is to record information on the report form or document. This information may be alphabetic or numerical, and it may be printed one line for each card (detail printing), or one line for a group of cards (group printing).

The print unit consists of a variable number of typebars, depending upon the size of the machine. The maximum number of typebars is 88, of which 43 will print both alphabetic and numerical information, and 45 will print numerical information only. The 43 alphabetic and numerical (alphamerical) typebars are located on the left side of the print unit, and the 45 numerical typebars on the right side. The two sets of typebars are separated from each other by a space equivalent to one typebar.

Each alphamerical typebar consists of the 26 alphabetic characters, the numbers 0 through 9, and a special character position that contains the ampersand character (&). Each numerical typebar consists of the 10 numerals and one symbol. In odd-numbered typebars the symbol is an asterisk (*), and in even-numbered typebars it is a credit symbol (CR).

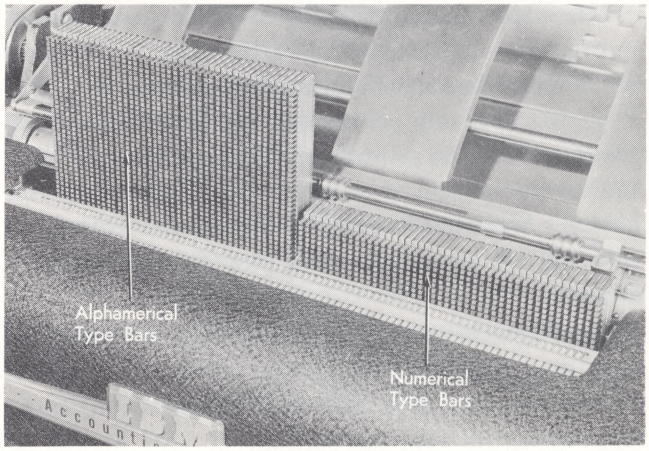


FIGURE 53. PRINT UNIT

A ribbon, similar to that used on typewriters, moves behind the typebars from a spool on the right to a spool on the left. When the right spool is completely unwound, the action is automatically reversed.

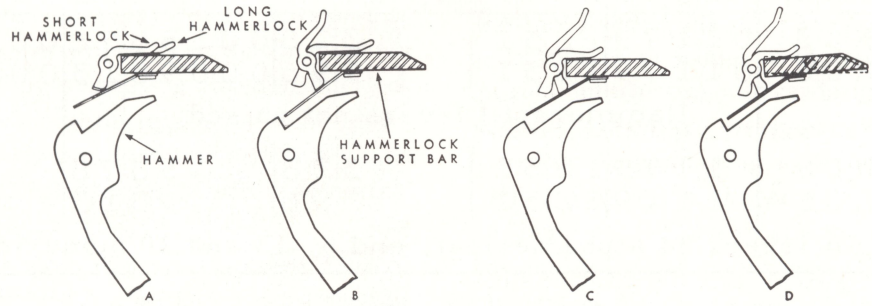
The character in the typebar that will be positioned for printing is determined by the holes punched in the card, or by the totals that the machine has accumulated. Behind each typebar is a hammer that fires after the typebar has been positioned, forcing the typebar character against the paper.

Hammerlock Levers

Each typebar in the machine is equipped with two types of hammerlock levers (Figure 54): a short lever, which is the one on the right, and a long lever, which is the one on the left. When both levers are down (Figure 54A) the hammer will hit the typebar on every cycle, and printing from the typebar will take place normally.

When the short hammerlock lever is raised (Figure 54B), the hammer will not hit the typebar, and no printing will take place from that typebar.

When the long hammerlock lever is raised, the firing of the hammer is under the control of the wiring on the control panel. If the conditions set up on the control panel for suppression of printing are not present, the hammer will fire because the support bar remains in a normal position (Figure 54C). When such conditions are present, the hammer will not fire because the support bar is tilted just enough to stop it from firing (Figure 54D).



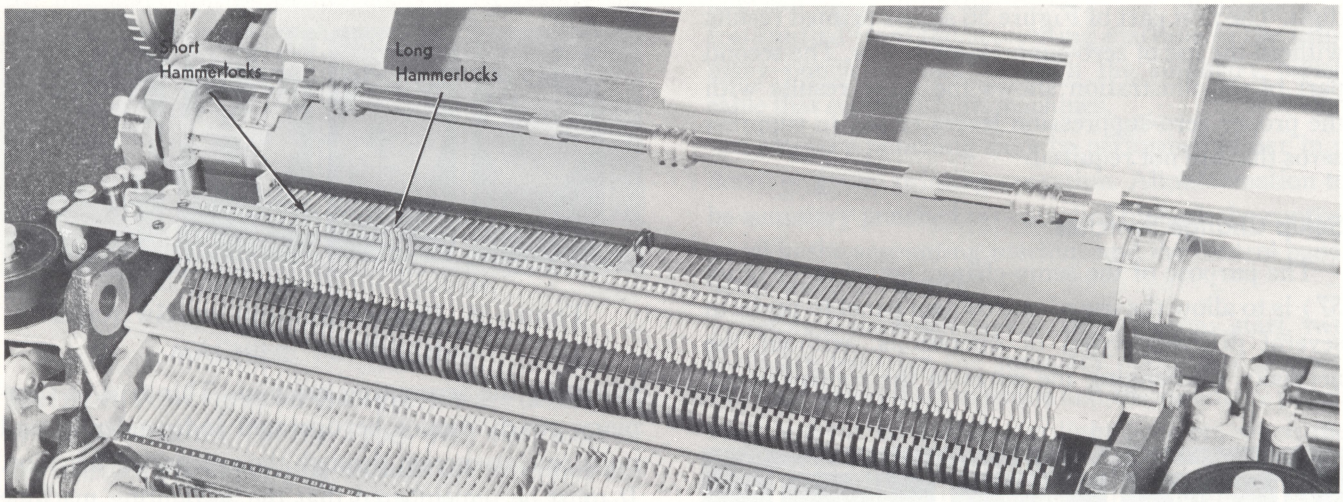


FIGURE 54. HAMMERLOCK LEVERS

The long hammerlocks have one general purpose, to suppress the printing of all or part of the information on particular cards, or to suppress the printing of totals. This is accomplished by raising the long hammerlocks for those typebars from which printing is to be suppressed.

The long hammerlock levers can also be used for indicating only the first card of minor, intermediate, or major program groups. This function is known as group indication.

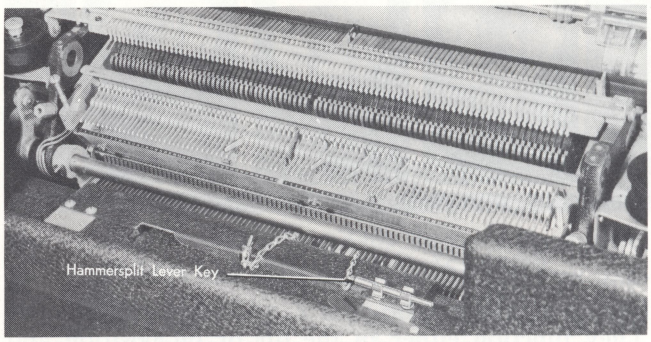


FIGURE 55. HAMMERSPLIT LEVERS

Hammersplit Levers

Each typebar is equipped with a hammersplit lever (Figure 55), usually referred to as a zero-suppression lever. Each lever, when raised, suppresses the printing of zeros to the right of the units digit printing in a column of a report, so that unnecessary zeros in the adjoining column are eliminated.

Zeros in the alphamerical typebars print only when they are punched in the cards, are wired on the control panel, and have a significant digit printing to the left. They are known as electrical zeros.

The first part of Figure 56 shows printing from the alphamerical typebars without the use of zero-suppression levers. The second part shows the same printing with the proper zero-suppression levers raised to suppress the electrical zeros that are not required.

When the numerical typebars are not wired, mechanical zeros print to the right of any significant

```
24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43  1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
A B B O T   B R O S  0 1 1 7 9 1 2 3 1 |     3 1 8 0 0 1 5 8 7 8 0 0 1 5 5 6 0 0 0
A B B O T   B R O S  0 1 1 7 9 1 2 3 1 |     1 9 6 0 0 0 9 8 1 3 0 0 0 9 6 1 7 0 0
                    Hammersplit levers not raised.
A B B O T   B R O S    1 1 7 9 1 2 3 1 |     3 1 8   1 5 8 7 8     1 5 5 6 0
A B B O T   B R O S    1 1 7 9 1 2 3 1 |     1 9 6     9 8 1 3       9 6 1 7
Hammersplit levers 34 alphamerical, and 6, 13 and 20 numerical raised.
```

FIGURE 56. ZERO PRINTING

digit. The first part of Figure 56 shows printed results without the use of zero-suppression levers. The second part of the illustration shows the same results with the proper zero-suppression levers raised to suppress zeros that are not required.

Setup Change Switches

The purpose of the setup-change switches (Figure 57) is to allow the use of one control panel to perform several different types of operations, without the necessity of changing the wires in the control panel.

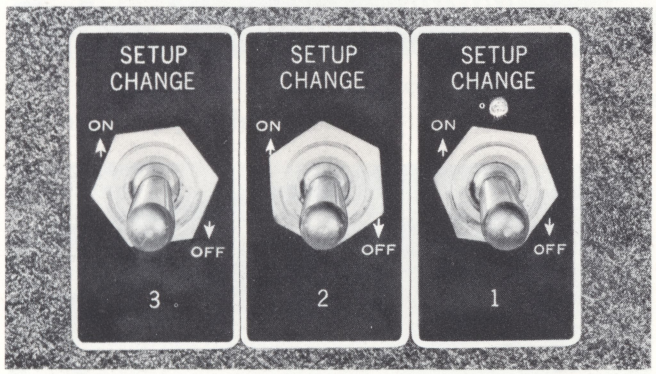


FIGURE 57. SETUP CHANGE SWITCHES

They function either in the off or on position and should be set according to written or verbal instructions from the supervisor. One simple example of their use would be changing from a detail printing operation to group printing.

Gangpunch Switch

The gangpunch switch (Figure 58) must always be off when the accounting machine is used. Its only purpose is to allow a special type of summary punch, which is connected by a cable to the accounting machine, to be used independently as a gangpunch without using the accounting machine. This type of summary punch cannot be operated independently and must receive current through the accounting machine. It must be remembered that the accounting machine cannot be operated when the gangpunch switch is on.

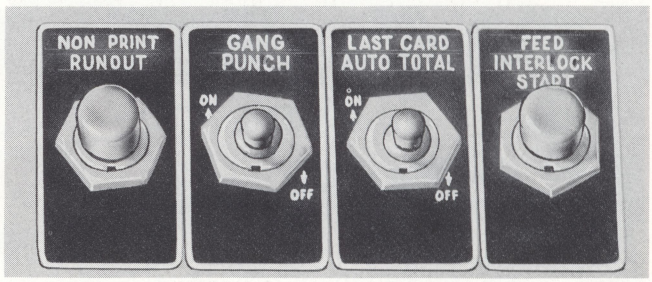


FIGURE 58. RUNOUT BUTTONS AND SWITCHES

Last Card Automatic Total

When this switch is on, all normal program controls are suspended, and a major program change is forced on both the run-in and runout, regardless of control panel wiring. When this switch is off, program control wiring will function in the normal manner. The primary purpose of this switch is to provide a means of obtaining totals automatically on the runout, without the necessity of program control.

Non-Print Runout Button

This button may be depressed if for any reason it is desired to run cards out of the machine without printing on the report.

Feed Interlock Start

The purpose of the feed interlock is to stop the machine and prevent accidental total printing in the event of a card feed failure. If a card fails to feed from the hopper, the machine stops. At this point, there are cards in the hopper and cards in the machine, one of

which is about to add, subtract or print, according to the operation being performed. The machine cannot be restarted except by depressing the feed-interlock start button, at which time the card about to be added, subtracted, or printed runs out into the stacker. On its way to the stacker, this card performs all the normal functions except comparing.

The card in the hopper that failed to feed must be made over. The last card in the stacker must then be placed in front of the corrected card and the rest of the file, and inserted in the hopper. To restart the machine, the feed-interlock start button must be depressed. On the run-in, the first card does not add, subtract, or print, but it does compare. The operation for succeeding cards will be normal.

If it is not desirable to continue the run after a card feed failure, it will be necessary to clear the feed interlock before a new run may be started. This is done by passing a blank card through the machine.

MACHINE FUNCTIONS

MACHINE FUNCTIONS on the Type 405 are performed by toggle switches. On the Types 402, 403, most of the switches are eliminated because the functions are wired on the control panel. Some of the main functions are described as follows:

Detail Printing

Detail printing is the printing of information from each card as it passes through the machine. The maximum speed of this operation is 100 cards per minute.

Group Printing

Group printing is the operation in which information on each card is automatically accumulated, but not printed. The only information printed is the indicative data sufficient to identify the group of cards and the totals for each group of cards. The maximum speed of this operation is 150 cards per minute.

Programming

Programming is the function by which the machine can distinguish the cards of one group from those of another. There are three classifications of program control: major, intermediate, and minor. For example, if automatic totals are desired by states, counties, and cities, state would be the major group, county would be the intermediate group, and city would be the minor group.

Summary Punching

Summary punching is the recording of summary or total information into cards, in the form of punched holes. For example, when an inventory report is prepared on an accounting machine, it can be set up to show, by each type of product or material, the balance on hand at the first of the month, the receipts and issues during the month, and the balance on hand at the end of the month. As totals are printed by each type of product, the information can be automatically punched into summary cards. This information is transmitted from the accounting machine to the summary punch machine through the summary punch cable that connects both machines.

Summary punching may be performed either in a detail or group printing operation. All information to be summary punched is controlled by both the control panel in the accounting machine and the control panel in the summary punch.

Before a summary punch operation may start, two cards are fed from the summary punch feed hopper. Both the accounting machine and the summary punch stop, and the card feed stop light goes on, when the feed hopper on either machine is empty.

OPERATING POINTERS

CARDS MUST be joggled and arranged in perfect alignment before placed in the hopper, face down with the 9's toward the throat.

Always make a short test run to make certain that the report form is properly positioned in the carriage. The test should prove that the control panel is properly wired to handle every situation that will occur throughout the operation. This includes the control of the counters and the other special conditions indicated on the cards by X's or other types of control punching. The test deck used by the operator is usually made by the person who analyzed the requirements of the report and wired the control panel.

Never attach the connector cable of the summary punch to the accounting machine unless the main-line switches of both machines are off. When starting an operation, always hold the start key down for at least three card cycles.

Never turn off the main-line switch to stop card feeding. Use the stop key.

Watch the control information occasionally to see that the totals print at the end of each control group.

For small groups of four or five items, it is good practice to check the total of items listed.

Cards may be added to the hopper and removed from the stacker without stopping the machine. However, if there is less than one inch of cards in the hopper at the time of reloading, the machine should be stopped. If this is not done, cards may fail to feed because of the lack of sufficient weight when the card weight is removed.

In handling the cards, be careful that the cards that have gone through the machine are stacked in the proper containers. Cards that have gone through the machine should be kept separate from the cards that are to go into the hopper. Carelessness in handling either group of cards leads to confusion and inaccurate reports.

Run out the cards by depressing the start key after the report is completed, as the last three cards do not run into the stacker automatically.

When a card fails to feed, the following operations must be performed:

1. Remove the cards from the hopper.
2. Run the cards in the machine into the stacker by depressing the feed interlock start button.
3. Make over the card that failed to feed.
4. Place the last card in the stacker in front of the corrected card, and place both cards in front of the rest of the file. Insert them in the hopper.
5. Restart the machine by depressing the feed-interlock start button.
6. If the run is not to be continued, clear the feed interlock by passing a blank card through the machine.

HOW TO OPERATE THE TYPES 402, 403 ACCOUNTING MACHINES

1. Make sure that you understand the operation to be performed. If in doubt, ask the supervisor to explain fully.
2. See that the cord is plugged to the proper source of current.
3. Insert the proper control panel in the slide and clamp it tightly.
4. If summary cards are to be punched, connect the summary punch cable to the accounting machine and insert the summary punch control panel.
5. Set the necessary hammerlock and hammersplit levers according to instructions.
6. Turn on the main-line switch. If the summary punch is to be used, feed two cards through the summary punch.
7. Insert the proper report form and position it correctly.
8. Joggle the cards before placing them in the hopper, face down with the 9's toward the throat.
9. Make a test run. It is necessary to hold the start key down for at least three card cycles. Any errors in the test run should be brought to the attention of the supervisor. If the test is satisfactory, you are ready to start the operation.
10. Load the hopper (not too full) with cards to be processed, always placing the card weight on top.
11. Store the cards from the stacker in the proper receptacles.
12. When the report is finished, turn off the main-line switch and give the completed report to the supervisor.
13. File the processed cards according to instructions.

REVIEW QUESTIONS

1. What is the purpose of the Types 402, 403 Accounting Machines?
2. What other functions besides printing can the machines perform?
3. What is their maximum speed?
4. Where is the control panel inserted?
5. What happens when the last card leaves the hopper?
6. Is it possible to add cards in the hopper or remove them from the stacker when the machine is running?
7. What conditions must be satisfied before a final total may be taken?
8. Name the five lights and describe the purpose of each.
9. How many of the typebars can print both alphabetic and numerical information? Where are they located?
10. How many of the typebars can print numerical information only? Where are they located?
11. What symbol can be printed from the odd-numbered numerical typebars?
12. What symbol can be printed from the even-numbered numerical typebars?
13. What is the purpose of the short hammerlock levers?
14. What is the purpose of the long hammerlock levers?

15. How many long and how many short hammerlock levers are there?

16. What is the purpose of raising a hammersplit lever?

17. How do zeros print from the alphamerical typebars? From the numerical typebars?

18. If information is to be printed from the numerical typebars 1-9, 17-23, and 32-37, what hammersplit levers must be raised?

19. What is the purpose of the setup change switches?

20. What happens when the non-print runout button is depressed?

21. Explain detail and group printing.

22. Is detail printing faster or slower than group printing?

23. What is programming?

24. Name the three types of program control.

25. What is summary punching?

26. How is information in the accounting machine transmitted to the summary punch machine?

27. If cards are placed in the hopper of both the accounting machine and the summary punch, and the accounting machine will not start when the start key is depressed, what is most likely the reason?

28. How long should the start key be held down when starting an operation?

29. Do cards automatically run out of the machine into the stacker when the report is completed? If not, how are they run out?

30. What steps must be taken when the accounting machine stops because of a card feed failure?

TYPE 407

THE TYPE 407, like other accounting machines, operates automatically both in the feeding of cards and in the printing of results. Information in cards can be read, added, subtracted, compared, selected, or printed at the speed of 150 cards per minute. Printing occurs at the same speed as the reading of the cards; and if all typewheels are used, 18,000 characters can be printed in one minute. Complete flexibility is provided in the arrangement of the printed data on the report form, and summary cards can be punched simultaneously with the preparation of reports. The machine is also capable of multiple-line reading (MLR).

OPERATING FEATURES

Control Panel

The control panel, the "brain" of the machine, controls the reading of information from the card and the printing of this information in the desired location on the report form. The control panel is inserted in a rack provided for it on the right end of the machine, as seen in Figure 59.

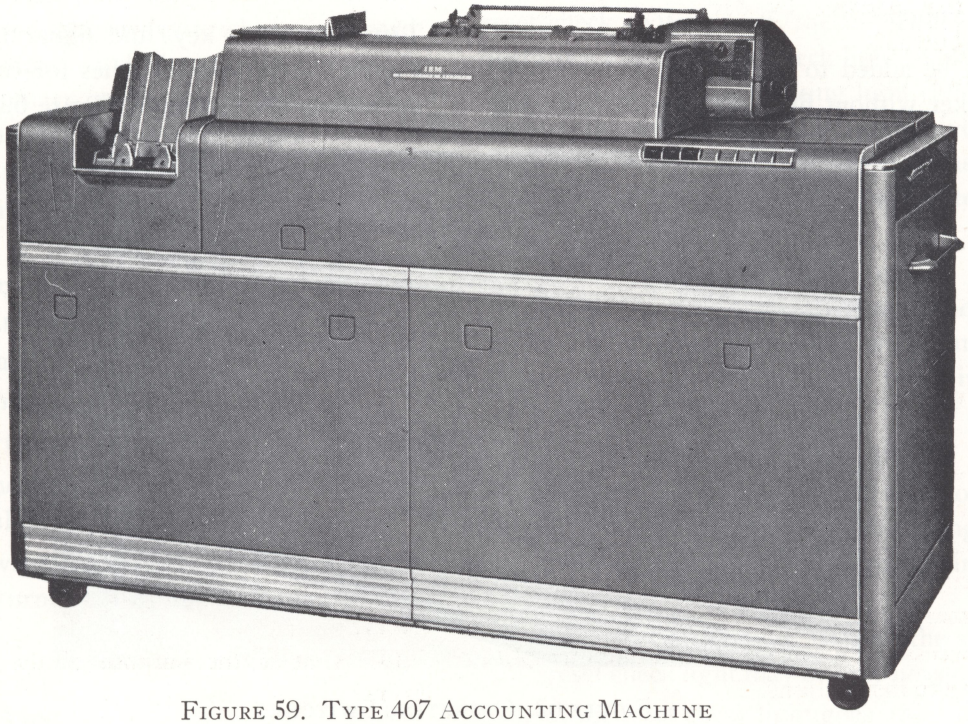


FIGURE 59. TYPE 407 ACCOUNTING MACHINE

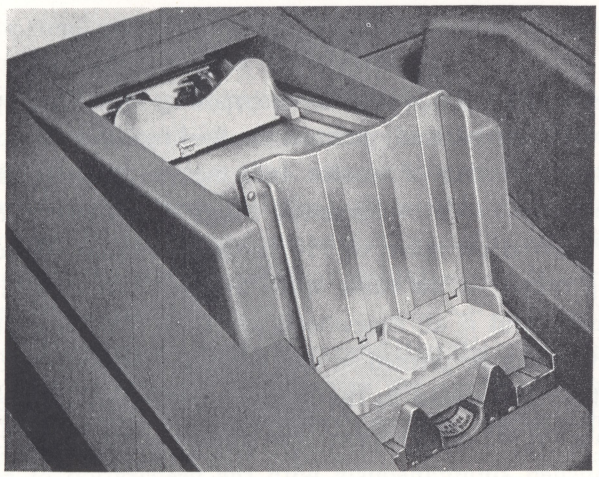


FIGURE 60. HOPPER AND STACKER

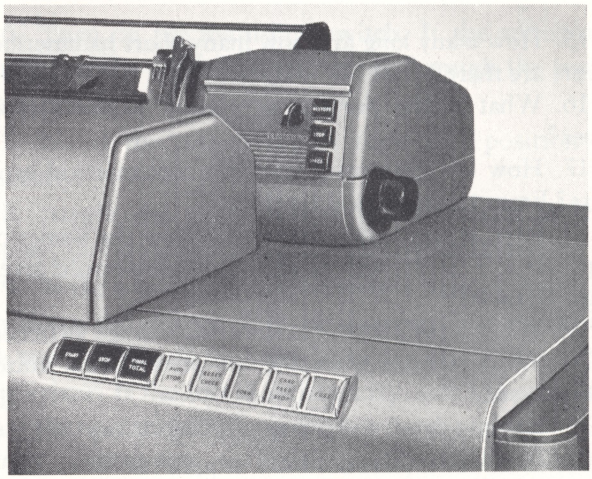


FIGURE 61. OPERATING KEYS AND SIGNAL LIGHTS

Feed Hopper and Stacker

The card feed hopper and stacker (Figure 60) are located to the left of the print unit. Cards are placed in the hopper face down with the 9 edge of the card toward the throat. The cards are fed into the machine from the bottom of the deck under the control of the feed knives and feed rolls. The hopper will hold about 1,000 cards; and if the hopper becomes empty during the automatic operation of the machine, the machine will stop.

The cards pass through the feed and are then automatically placed in the stacker, which is located above and behind the hopper.

Cards may be added to the hopper and removed from the stacker without first stopping the machine.

Print Unit

Printing on the Type 407 is accomplished by means of 120 typewheels arranged in a solid bank, which prints within a width of 12 inches, 10 characters to the inch. The print wheels are all the same and consist of the following 47 separate character positions:

10 digits: 0 through 9
26 letters: A through Z
11 special characters:
/ $ □ * % @ & - # . ,

OPERATING KEYS, SWITCHES, AND SIGNAL LIGHTS

THE OPERATING keys and signal lights are shown in Figure 61, and the switches for controlling machine operations are shown in Figure 62.

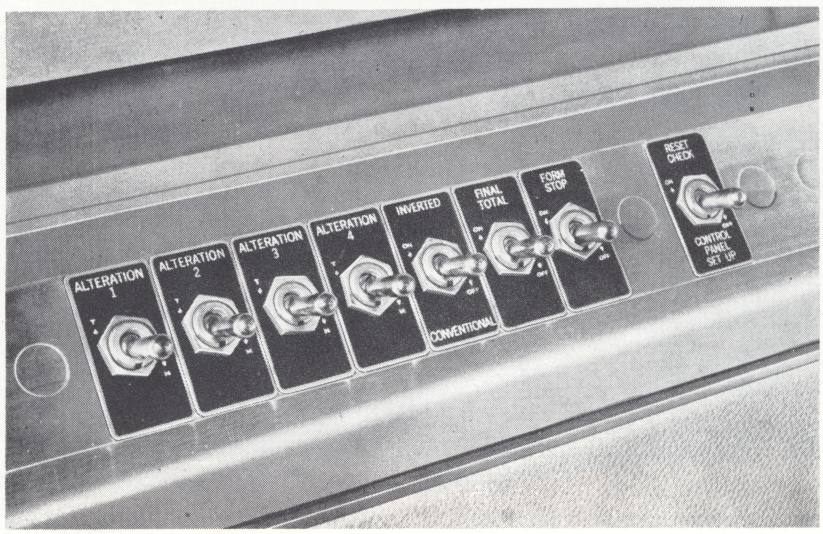


FIGURE 62. OPERATING SWITCHES

Main-Line Switch

The main-line switch (not shown in the illustration) applies power to the machine when it is on, and, of course, must be on to operate the machine. This switch should not be turned off while cards are feeding or during any other machine operation. It is located on the left end of the machine.

Start Key

The start key must be depressed to start feeding cards through the machine. It is also used to turn off the form stop light and the automatic stop light.

Stop Key

Depressing the stop key stops the machine before the next card is fed. However, if a total cycle is in process or is about to be started, the machine continues until it is completed. The stop key is also used to turn off the card feed stop light.

Final-Total Key

The final-total key is used to print and reset final totals manually if they are wired on the control panel. There is a final-total switch on the machine, and it must be on before the final-total key is operative.

Card-Feed Stop Light

The card-feed stop light turns ON whenever a card fails to feed. It also turns ON during a summary punch operation if the summary punch fails to feed a card or if the summary punch hopper becomes empty.

The light can be turned OFF by the following procedure if a feed failure has occurred in the accounting machine:

1. Remove the cards from the hopper and correct the bottom card that failed to feed.
2. Replace the cards in the hopper.
3. Press the stop key to turn the light OFF.
4. Press the start key to resume operation.

The cards will then feed normally without interruption of the normal control or spacing operations.

The light is on when the summary punch hopper is empty; it may be turned off by the following procedure:

1. Replenish the hopper.
2. Press the start key.

Form Stop Light

The form stop light turns on and the machine is stopped when the last form is within 13⅜ inches of the platen. This is true, however, only if the form stop switch is ON. The form stop light is turned off by inserting a new form and depressing the start key.

Automatic Stop Light

The automatic stop light turns on when the machine is stopped by control panel wiring. The light can be turned off and the operation resumed by merely depressing the start key.

Fuse Light

The fuse light turns on, and the machine is stopped when a fuse burns out. The light remains on until the fuse has been replaced and the start key depressed.

Light (Unlabeled)

This light (the upper half of the form stop light) is on when the main-line switch is on and the machine is idling; i.e., not feeding cards, printing, etc.

Reset Check Light

The reset check circuit is designed to determine whether counters in the machine are reset correctly. The circuit is controlled by a reset check switch. If the reset check switch is off, the test circuit is made inoperative, and the reset check light blinks during machine operation. This blinking light calls attention to the fact that the test circuit is inoperative. If the reset check switch is on, the check light turns on, and the machine stops only when an error is detected as a result of an incorrect reset.

A reset error is most often caused by improper counter wiring. The cards in the machine must be run out into the stacker before the error can be detected and corrected. To do this, the following steps are necessary:

1. Remove cards from the hopper.
2. Depress the start key to run cards out of the machine. At this time re-programming occurs, and the counters are reset a second time. The machine continues to run.
3. To stop the machine, depress the stop key. The reset check light may or may not go off.
4. If the reset check light goes off, it means that all

cards are out of the machine and are in the stacker.

5. If the reset check light is still on, there are still cards in the machine. To run them out it is now necessary to:
   a. Turn off the reset check switch.
   b. Depress the start key and run the cards out into the stacker.
   c. Depress the stop key to stop the machine. The reset check light turns off when the machine stops.

Alteration Switches 1, 2, 3, and 4

When turned on, an alteration switch transfers a corresponding selector on the control panel. These selectors can be used to alter control panel setups.

Inverted Switch

The inverted switch must be on whenever inverted forms are being run. Inverted forms are those in which detail cards precede the heading cards. The switch must be off for running conventional forms.

Final-Total Switch

With the final-total switch on, final totals can be manually printed and reset by depressing the final total key, provided the final total hubs on the control panel have been properly wired. It also permits the runout final total to print automatically when the LCT (last card total) switch is on. The LCT switch is a pluggable switch located on the control panel.

With the final-total switch off, neither final totals nor runout final totals can be taken and the final total remains in the machine indefinitely.

Form Stop Switch

With the form stop switch on, the end of the form stop, located in the center of the carriage, is operative and causes the machine to stop when the last form is within 13⅜″ of the printing line. With the form-stop switch off, the end of the form stop is inoperative.

Reset Check Switch

The purpose of the reset check switch is explained under *Reset Check Light.*

MACHINE FUNCTIONS

Detail Printing

Detail printing is the printing of information from each card as it passes through the machine. This is accomplished at the rate of 150 cards per minute.

Group Printing

Group printing is the operation in which information on each card is automatically accumulated but not printed. The only information printed is the indicative data sufficient to identify the group of cards and the totals for each group of cards. This operation is accomplished at the rate of 150 cards per minute.

Programming

Programming is the function by which the machine can distinguish the cards of one group from those of another. There are three classifications of program control: minor, intermediate, and major. For example, if automatic totals are desired by states, counties, and cities, state would be the major group, county would be the intermediate group, and city would be the minor group.

Summary Punching

Summary punching is the recording of summary or total information into cards, in the form of punched holes. For example, when an inventory report is prepared on an accounting machine, it can be set up to show, by each type of product or material, the balance on hand at the first of the month, the receipts and issues during the month, and the balance on hand at the end of the month. During the preparation of this report, totals are printed by each type of product and this information can be automatically punched into summary cards. This information is transmitted from the accounting machine to the summary punch machine through the summary punch cable that connects both machines.

Summary punching may be performed either in a detail or group printing operation. All information to be summary punched is controlled by control panel wiring.

Before a summary punch operation may start, two cards must be fed into the summary punch from the punch feed hopper.

cards are out of the machine and are in the stacker.

5. If the reset check light is still on, there are still cards in the machine. To run them out it is now necessary to:
   a. Turn off the reset check switch.
   b. Depress the start key and run the cards out into the stacker.
   c. Depress the stop key to stop the machine. The reset check light turns off when the machine stops.

Alteration Switches 1, 2, 3, and 4

When turned on, an alteration switch transfers a corresponding selector on the control panel. These selectors can be used to alter control panel setups.

Inverted Switch

The inverted switch must be on whenever inverted forms are being run. Inverted forms are those in which detail cards precede the heading cards. The switch must be off for running conventional forms.

Final-Total Switch

With the final-total switch on, final totals can be manually printed and reset by depressing the final total key, provided the final total hubs on the control panel have been properly wired. It also permits the runout final total to print automatically when the LCT (last card total) switch is on. The LCT switch is a pluggable switch located on the control panel.

With the final-total switch off, neither final totals nor runout final totals can be taken and the final total remains in the machine indefinitely.

Form Stop Switch

With the form stop switch on, the end of the form stop, located in the center of the carriage, is operative and causes the machine to stop when the last form is within 13⅜" of the printing line. With the form-stop switch off, the end of the form stop is inoperative.

Reset Check Switch

The purpose of the reset check switch is explained under *Reset Check Light.*

MACHINE FUNCTIONS

Detail Printing

Detail printing is the printing of information from each card as it passes through the machine. This is accomplished at the rate of 150 cards per minute.

Group Printing

Group printing is the operation in which information on each card is automatically accumulated but not printed. The only information printed is the indicative data sufficient to identify the group of cards and the totals for each group of cards. This operation is accomplished at the rate of 150 cards per minute.

Programming

Programming is the function by which the machine can distinguish the cards of one group from those of another. There are three classifications of program control: minor, intermediate, and major. For example, if automatic totals are desired by states, counties, and cities, state would be the major group, county would be the intermediate group, and city would be the minor group.

Summary Punching

Summary punching is the recording of summary or total information into cards, in the form of punched holes. For example, when an inventory report is prepared on an accounting machine, it can be set up to show, by each type of product or material, the balance on hand at the first of the month, the receipts and issues during the month, and the balance on hand at the end of the month. During the preparation of this report, totals are printed by each type of product and this information can be automatically punched into summary cards. This information is transmitted from the accounting machine to the summary punch machine through the summary punch cable that connects both machines.

Summary punching may be performed either in a detail or group printing operation. All information to be summary punched is controlled by control panel wiring.

Before a summary punch operation may start, two cards must be fed into the summary punch from the punch feed hopper.

OPERATING POINTERS

CARDS MUST be joggled and arranged in perfect alignment before placed in the hopper, face down with the 9 edge toward the throat.

A short test run should always be made to make certain that the report form is properly positioned in the carriage. (To position the form correctly, see the *Type 922 Carriage Section.*) The test should prove that the control panel is properly wired to handle every situation that will occur throughout the operation. This includes the control of the counters and the other special conditions indicated on the cards by X's or other types of control punching. The test deck used by the operator is usually made by the person who analyzed the requirements of the report and wired the control panel.

Never attach the connector cable of a summary punch machine to an accounting machine unless the main-line switches of both machines are off. Always hold the start key down for at least two card feed cycles when starting an operation.

Never turn off the main-line switch to stop card feeding. Instead use the stop key.

Watch the control information occasionally to see that the totals print at the end of each control group. For small groups of four or five items, it is good practice to check the total of items listed occasionally.

Cards may be added to the hopper and removed from the stacker without first stopping the machine. However, if there is less than one inch of cards in the hopper at the time of reloading, the machine should be stopped. If this is not done, cards may fail to feed because of the lack of sufficient weight when the card weight is removed.

In handling the cards, be careful that the cards that have gone through the machine are stacked in the proper containers and kept separate from the cards that are to go into the hopper. Carelessness in handling either group of cards leads to confusion and inaccurate reports.

As a report is completed, run the cards out of the machine by depressing the start key, because some cards may not run out to the stacker automatically. This will not be necessary if the runout switch is wired on the control panel.

When a card fails to feed, the steps listed under card-feed stop light should be followed to correct the situation.

HOW TO OPERATE THE TYPE 407 ACCOUNTING MACHINE

1. Make sure that you understand the operation to be performed. If in doubt, ask your supervisor for complete details of the operation.

2. Check to see that the power cord is plugged into the proper voltage source.

3. Insert the proper control panel in the rack and close it tightly.

4. If summary cards are to be punched, connect the summary punch cable to the accounting machine and insert the summary punch control panel.

5. Set the control switches according to the instructions for the particular report being run.

6. Turn on the main-line switches of both machines if summary punching. Also, if summary punching, feed two cards into the summary punch.

7. Insert the proper report form and position it correctly (see section on the Type 922 Tape-Controlled Carriage).

8. Joggle and place the test cards in the hopper, face down with the 9 edge toward the throat.

9. Make a test run. It is necessary to hold the start key down for at least two cycles to obtain automatic operation. Any errors in the test run should be brought to the attention of the supervisor. If the test is satisfactory, you are ready to start the operation.

10. Load the hopper (not too full) with the cards to be processed, always placing the card weight on top.

11. Store the cards from the stacker in the proper receptacles.

12. When the report is finished, turn off the main-line switch and give the completed report to the supervisor.

13. File the processed cards according to instructions.

REVIEW QUESTIONS

1. What is the purpose of the Type 407 Accounting Machine?

2. What functions other than printing can this machine perform?

3. At what speed does the Type 407 operate?

4. Where is the control panel inserted?

5. What happens when the last card leaves the hopper?

6. Is it possible to add cards in the hopper while the machine is running? Remove cards from the stacker?

7. Can a final total be taken automatically? Manually?

8. Name the six lights and describe the purpose of each.

9. How many typewheels does the 407 have? How many can print both alphabetic and numerical information?

10. How many different special symbols can be printed from a typewheel? What are they?

11. Explain detail and group printing.

12. What is programming?

13. Name four types of automatic totals.

14. Assume the card feed stop light is on. Describe the procedure to turn it off.

15. Describe the procedure to turn off the reset check light.

16. What is the purpose of the alteration switches?

17. What is summary punching?

18. How is information in the accounting machine transmitted to the summary punch machine?

19. If cards are placed in the hopper of both the accounting machine and the summary punch, and the accounting machine will not start when the start key is depressed, what is most likely the reason?

20. Do cards automatically run out of the machine into the stacker when the report is completed?

IBM AUTOMATIC CARRIAGES

A CARRIAGE is that part of an accounting machine into which paper is inserted for the preparation of a report. The early standard carriages were as simple in construction and operation as those found on standard typewriters, and paper was inserted around a platen in much the same way. The main difference between carriages on typewriters and carriages on accounting machines is that on accounting machines the carriage does not move from right to left because all the printing on one line occurs simultaneously. Thus, there is no need for returning the carriage. Line spacing (single, double, or triple) is automatic.

Because of the high speed of printing, inserting single sheets of paper is rarely done on an accounting machine. Reports are usually prepared on plain roll paper, fanfold paper, or preprinted continuous forms.

When reports are prepared on plain roll paper, one end of the roll is inserted in the carriage around the platen. Once printing is started, the operation continues until the report is completed and requires very little attention from the operator. When reports are prepared on fanfold paper or preprinted continuous forms, standard carriages are not very efficient because constant attention from the operator is required. The accounting machine must be stopped by the operator at the end of each form. The paper is then advanced to the next form by manually turning a platen knob.

Automatic carriages, of which there are three types, have been developed for handling preprinted continuous forms. The Type 921, attached to the Type 405, 416 Accounting Machines, can be adjusted to handle continuous forms up to a maximum length of 18 inches. When the adjustable arms are properly set, this carriage will automatically advance forms through the machine to meet a variety of situations set up by the control panel. The Types 922 and 923, attached to the Type 407 and Types 402, 403 Accounting Machines, respectively, serve a similar purpose. The setup is made by punching holes in a paper tape, which is inserted in the carriage by the operator. The tape may be used repeatedly. Forms up to a maximum length of 22 inches can be handled automatically as directed by the paper tape and control panel.

PRESENTED TO PAYMASTER SIGNATURE

THE NATIONAL MANUFACTURING CO.
BROADWAY, NEW YORK

PAY VOUCHER

NUMBER	NAME	DATE	AMOUNT DUE
1962	JOHN JONES	1 12	25.22

THIS VOUCHER MUST BE SIGNED AND PRESENTED TO PAYMASTER SIGNATURE

THE NATIONAL MANUFACTURING CO.
BROADWAY, NEW YORK

PAY VOUCHER

NUMBER	NAME	DATE	AMOUNT DUE
1963	AMOS BROWN	1 12	28.14

THIS VOUCHER MUST BE SIGNED AND PRESENTED TO PAYMASTER SIGNATURE

THE NATIONAL MANUFACTURING CO.
BROADWAY, NEW YORK

PAY VOUCHER

NUMBER	NAME	DATE	AMOUNT DUE
1964	RICHARD DOE	1 12	18.47

THIS VOUCHER MUST BE SIGNED AND PRESENTED TO PAYMASTER SIGNATURE

Single Item Ejection

COST ANALYSIS

JOB NUMBER	DRAW. NO.	OPER. NO.	AMOUNT
142 1500	4340	2301	796500
142 1500	3277	2311	65890
142 1500	6354	2321	1557850
			6653375*

Totals, in this case, cause ejection.

COST ANALYSIS

JOB NUMBER	DRAW. NO.	OPER. NO.	AMOUNT
157 2527	1125	1510	875500
157 2527	1256	1511	157850
157 2527	1453	1512	3478675
157 2527	2358	1513	79500
157 2527	2378	1514	765950
157 2527	3008	1515	1347860
157 2527	3056	1516	65450
157 2527	4530	1517	785000
157 2527	5688	1518	3786750
157 2527	6754	1519	22550
			11365085*

A total appearing directly following a last-line stop is printed on the same form before ejection takes place.

Controlled and Form to Form Ejection

COST ANALYSIS

JOB NUMBER	DRAW. NO.	OPER. NO.	AMOUNT
142 1500	6274	2201	5465
142 1500	3192	2211	13450
142 1500	8416	2221	45075
142 1500	1598	2231	1050400
142 1500	1655	2241	345760
142 1500	4234	2251	5680
142 1500	4567	2261	190850
142 1500	8543	2271	35855
142 1500	2243	2281	2465600
142 1500	7870	2291	75000

Last-line stop effects ejection.

COST ANALYSIS

JOB NUMBER	DRAW. NO.	OPER. NO.	AMOUNT
142 1500	4340	2301	796500
142 1500	3277	2311	65890
142 1500	6354	2321	1557850
			6653375*
157 2527	1125	1510	875500
157 2527	1256	1511	157850
157 2527	1453	1512	3478675
157 2527	2358	1513	79500
157 2527	2378	1514	765950
157 2527	3008	1515	1347860

Totals, in this case, do not effect ejection.

Form to Form Ejection

NATIONAL MANUFACTURING CO.
NEW YORK

SOLD TO EUREKA POWER CORP
420 HUNTINGTON ROAD
DUANSBURGH NEW YORK

DATE	QUANT.	DESCRIPTION	UNIT PRICE	AMOUNT
5 11	12	MOTOR GENERATOR XXX2	4620	55440
5 11	6	MOTOR GENERATOR X27A	5950	35700
5 11	6	X27A GENERATOR BASE	625	3750
5 11	12	DRIVE SHAFT BEARING	113	1356
5 14	12	CONNECTING ROD 2A25	126	1512
5 14	8	AMMETER CASE 100 AMP	59	472
5 16	7	DUPLEX VOLTMETER	994	6958
5 26	19	TRANSFORMER K775	350	6650
5 26	21	TRANSFORMER K225	190	3990
				115828*

Control change causes eject.

NATIONAL MANUFACTURING CO.
NEW YORK

SOLD TO BAMLEY SALVAGE CO
JONESTOWN IDAHO

DATE	QUANT.	DESCRIPTION	UNIT PRICE	AMOUNT
5 12	6	DUPLEX VOLTMETER	994	5964
5 12	12	ARVIN AMMETER 45 AMP	620	7440
5 12	3	MOTOR GENERATOR X27A	5950	17850
5 12	10	MOTOR GENERATOR X45	2000	20000
5 12	4	TRANSFORMER K775	350	1400
5 16	12	TRANSFORMER K225	190	2280
5 16	12	DUPLEX VOLTMETER	994	11928
5 16	5	X27A GENERATOR BASE	625	3125
5 24	8	10 HP MOTOR	5000	40000
5 24	10	MOTOR BASE ROD	210	2100
5 24	12	PANEL BOARD	1424	17088
				127175*

Heading Card Operation

FIGURE 63. BASIC OPERATIONS

TYPE 921

BASIC OPERATIONS performed by automatic carriages are as follows (Figure 63):

Single-Item Ejection

This operation consists of ejecting the form after one single line has been printed on the form.

Form-to-Form Ejection

In this operation the carriage ejects the form after a predetermined number of lines have been printed, and places the second form in position for printing on the first printing line.

Controlled and Form-to-Form Ejection

This is a combination of form-to-form ejection and ejection as a result of a control change. In this operation, the carriage ejects the form after a certain number of lines have been printed and also ejects the form whenever there is a change in control. Thus, for each control group, printing begins on a new sheet.

Heading Card Operation

This operation spaces forms that consist of two sections, such as invoices, remittance statements, and checks. It combines controlled form-to-form ejection and other controlled spacing within the form to print the heading cards (name, address) in the heading section of the form, and the detail cards in the body section of the form.

Predetermined Total Line

In this operation, whenever the accounting machine is ready to print a total, the carriage spaces the form so that the total is printed on a predetermined line, usually near the bottom of the form. This operation is combined with controlled and form-to-form ejection or with heading card operations.

Single-Sheet Operation

Any of the foregoing operations can be performed with single sheets instead of continuous forms. Each sheet must be fed by hand. After the single sheet has been completed, the carriage will automatically eject it and stop the accounting machine. When a new sheet is inserted manually and the start key is depressed, the operation will be repeated.

Carriage Models

The two models of the Automatic Carriage differ only as to the maximum length of the forms that they control, and the speed with which ejecting occurs. The model 12 carriage controls a form up to 12 inches in length, and the model 18 a form up to 18 inches in length.

The model 12 carriage is provided with two ejection speeds, "short" and "medium." Short (or fast) speed is effective when short forms, up to and including 3-2/3 inches in length, are to be used. Medium speed is effective when longer forms, up to and including the maximum of 12 inches, are to be used. The speed adjustment on the carriage consists of two gear shift buttons by means of which either speed is engaged, and an interlock cam that makes it impossible to engage both speeds at the same time.

The model 18 carriage may have one of two different speed combinations, short-long or medium-long. If the short-long combination is provided, short speed may be used for forms up to and including 3-2/3 inches in length, and long speed for forms beyond that length. If the medium-long combination is provided, medium speed may be used for forms up to and including 8-1/2 inches in length, and long speed for forms beyond that length.

The following table summarizes the specifications for the two models, with regard to length of forms handled and speed of operation:

EJECTION SPEED AND LENGTH OF FORMS
Handled by different models of carriage

Ejection Speed	Model 12	Model 18 (short-long)	Model 18 (medium-long)
Short	Forms up to 3-2/3"	Forms up to 3-2/3"	
Medium	Forms 3-5/6 to 12"		Forms up to 8-1/2"
Long		Forms 3-5/6 to 18"	Forms 8-2/3 to 18"

OPERATING FEATURES

THE OPERATING FEATURES of the Automatic Carriage are shown in Figures 64, 65, and 66.

Carriage Motor

The carriage motor is attached to the carriage mechanism and supplies power for all carriage operations (Figure 64).

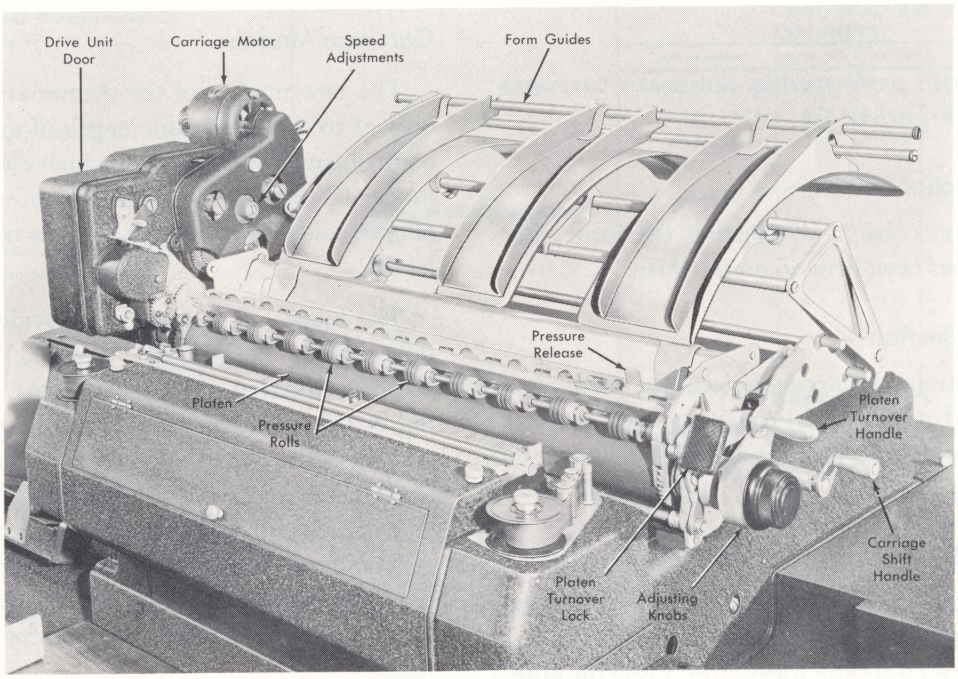


FIGURE 64. CARRIAGE FEATURES

Drive Unit Door

The door to the carriage mechanism provides access to the adjustable locating arms. When this door is open, the motor will not run. The door must always be closed when the accounting machine is in operation.

Platen Turnover Lock and Handle

The turnover paper inserting mechanism is operated by pressing with the heel of the hand on the lock, while the fingers of the same hand grip the operating handle and pull it upward and forward toward the operator. This movement brings the pressure rolls underneath the platen to the rear, where they can grip the paper. The paper is then placed in the paper chute, and the platen is advanced one notch manually to permit the pressure rolls to obtain a grip on the paper. Rotation of the platen turnover handle back to its normal position causes the paper to be drawn in by a distance determined by the setting of the starting line dial, and automatically locks the platen for printing.

Carriage Shift Handle

The lateral movement of the carriage in relation to the typebars of the accounting machine is 5-3/8 inches. The carriage may be shifted by pushing the carriage shift handle slightly to the left and rotating it in the desired direction. This lateral movement to correct vertical alignment may be made while the machine is in operation.

Adjusting Knobs

The platen is equipped with two knobs that are used to turn the platen. The large knob is used to turn the platen forward, one complete space at a time. The small knob may be used to move the platen forward or backward a fraction of a space in order to improve registration of printing on the form. This knob may be used for adjustment when the carriage is in operation.

Platen

The standard platen supplied with the machine may be replaced with special platens as required by the type of continuous form being used or the number of carbon copies being made.

Pressure Rolls

The pressure rolls hold the forms securely against the platen so that the forms move with the platen. When the platen is turned over for paper insertion, the pressure rolls are directly in line with the paper guides, and the turn of a single notch on the main platen knob causes the paper to be gripped by the rolls.

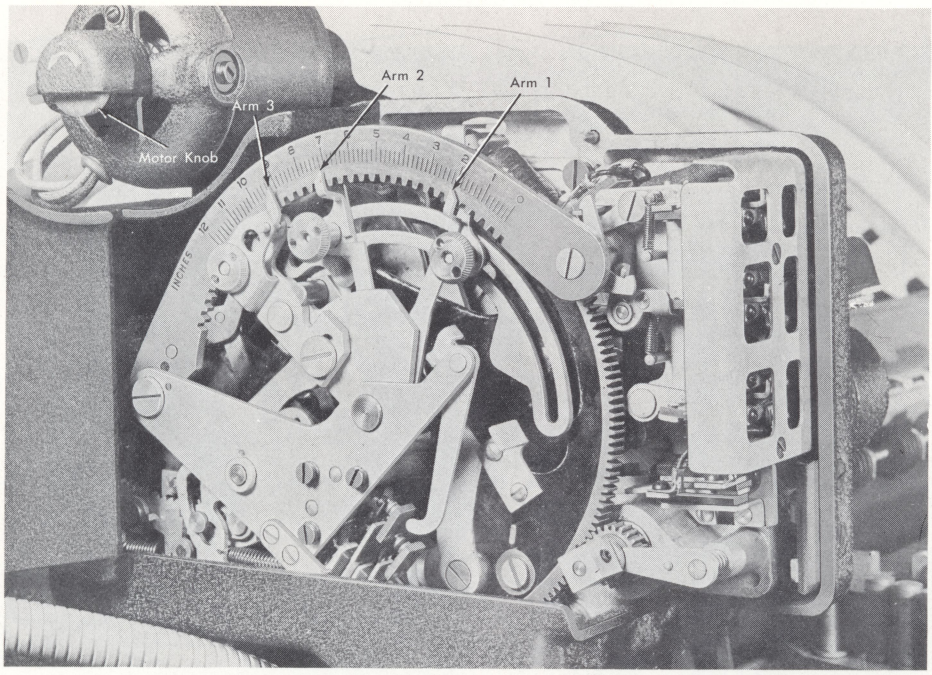


FIGURE 65. CARRIAGE MECHANISM

Pressure Release

A lever is provided for releasing the pressure rolls whenever it is necessary to re-adjust sheets or continuous forms. The pressure rolls should be released whenever special form feeding devices are in use.

Motor Knob

This knob (Figure 65) is used to turn the motor by hand when making speed adjustments.

Adjustable Locating Arms

Three adjustable arms are provided for setting the carriage to correspond to the length and arrangement of the forms being used. These arms are located inside the drive unit door. The arms are adjusted with reference to the scale, which is divided into 12 inches or 18 inches, depending on the model of the carriage. Each inch division is subdivided into six parts, each representing a line space. The method of settling the arms is described under *Adjustments* on pages 66-69.

Eject Clutch Button

When the carriage mechanism and the carriage (platen) are disengaged, the carriage performs only the line spacing functions of a standard carriage. When they are engaged, skipping and ejecting are controlled by the adjustable arms and the control panel. The eject clutch button (Figure 66) is used to engage or disengage the carriage as follows:

a. To engage, turn the eject clutch button clockwise until it snaps and locks into position.
b. To disengage, pull the clutch button out and turn it slightly counterclockwise.

Clutch Release Lever

This lever is used to disengage the platen clutch when the platen is to be turned backward by means of the large knob at the right end of the platen. The clutch release lever is moved to the left to disengage the platen from its driving mechanism.

The clutch need not be released when the platen is turned backward by means of the small knob.

Spacing Adjustment Lever

The spacing adjustment lever may be set for single, double, or triple spacing. Single spacing is six lines to the inch, double spacing three lines to the inch, and triple spacing two lines to the inch.

Manual Space-Eject Lever

This lever is provided in order that the carriage may be manually controlled to cause line spacing or ejecting. The lever normally rests in a central posi-

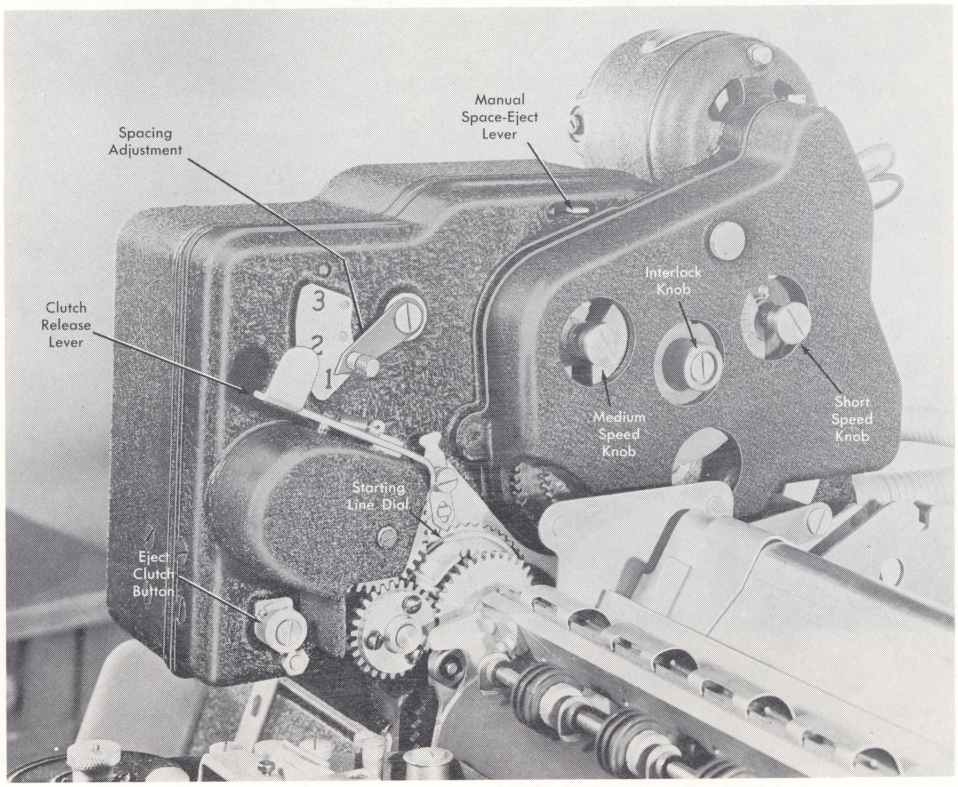


FIGURE 66. RIGHT SIDE OF CARRIAGE MECHANISM

tion. When it is moved to the front, it causes ejection to take place, provided the eject-clutch button is IN. When the lever is moved to the rear, it causes the carriage to line-space.

Speed Adjustment and Interlock Knobs

There are two gear shift knobs by means of which either speed is engaged. An interlock knob makes it impossible to engage both speeds at the same time.

Starting Line Dial

For a manually inserted form, the starting line dial (Figure 67) determines the distance from the top of the sheet to the first printing line. This distance can vary from 1 to 4-5/6 inches, in steps of one-sixth of an inch.

ADJUSTMENTS

THE CARRIAGE locating arms must be adjusted for each operation, as illustrated in Figure 68. The adjustment of the arms is made on the graduated scale, Y, which is divided to correspond to inches and sixths of an inch, or line spaces on the form.

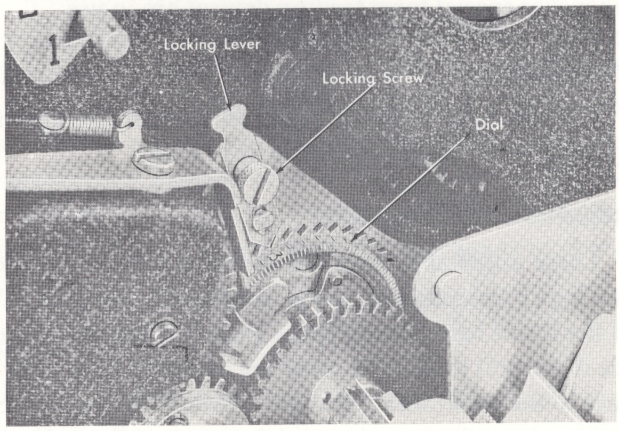


FIGURE 67. STARTING LINE DIAL

The function of the arms is to make it possible to set the carriage to handle forms of many different lengths and arrangements. As the form is moved (by line spacing, skipping, or ejecting) through the distances marked by the arm settings, impulses are available that may be used to control the carriage for further operations. Likewise, the carriage can be signalled, by control panel wiring, to move the form

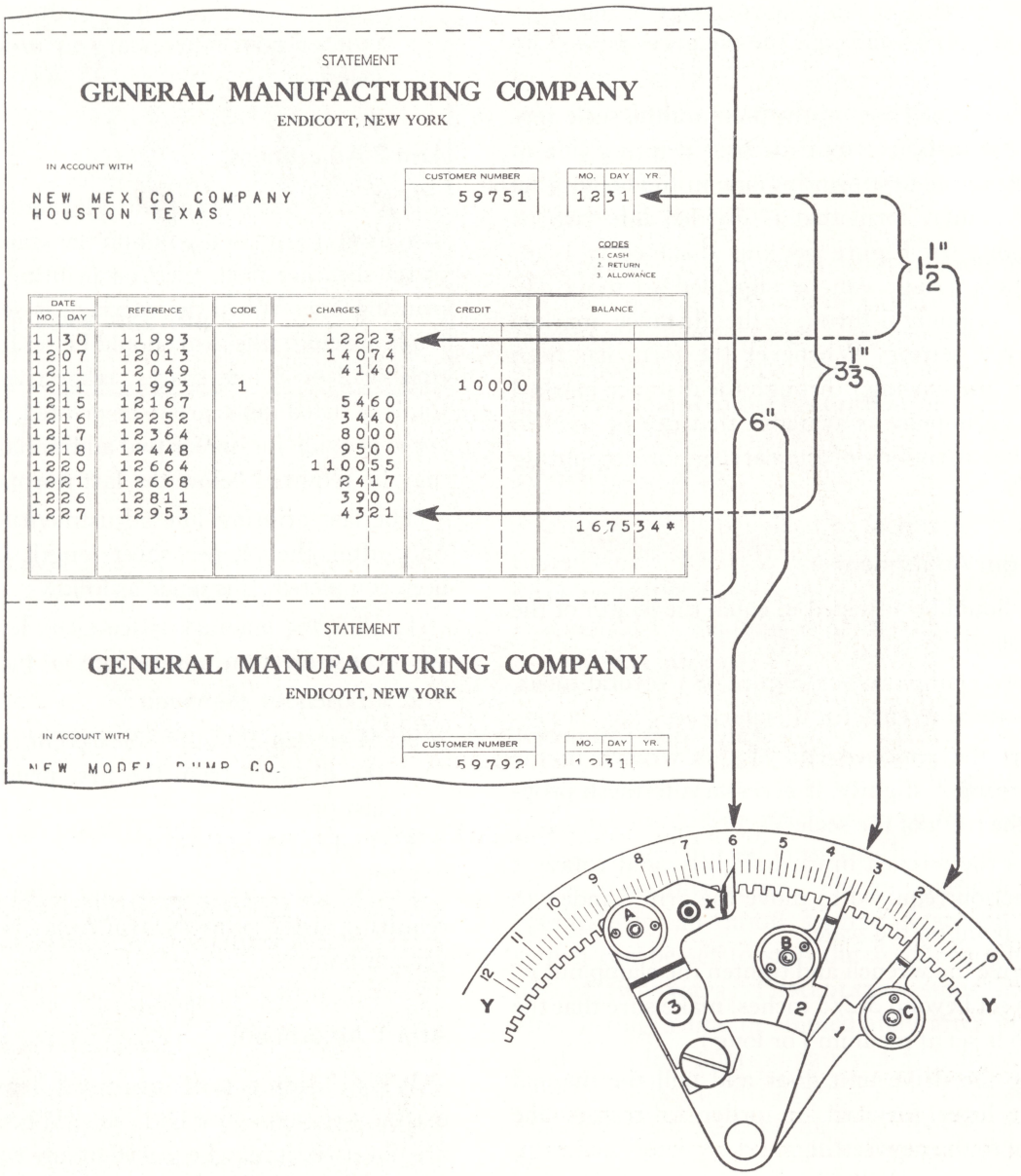


FIGURE 68. ADJUSTMENTS

through the distance marked by the setting of the arms.

Arm 3 is normally set to indicate the total length of the form, and determines the maximum movement of the form on an ejection. Thus, if arm 3 is set to 12, the maximum movement of the form once an ejection operation is started will be 12 inches. When arm 3 is set at a lower point on the scale, such as 4, then the maximum movement of the form will be 4 inches.

With arm 3 set to a point on the scale equal to the length of the form, and with the first form inserted so that the first line of printing is properly positioned, the following form is automatically positioned when an ejection takes place. In Figure 68, because the length of the form is six inches, arm 3 is set at 6.

Arm 2 is normally set at the point on the scale representing the distance from the first printing line to the last printing line on the form. In Figure 68, this is 3-1/3 inches. As printing takes place and the last printing line is reached (by line spacing), an impulse is available at the control panel that indicates the form has been moved through the distance set by arm 2. This impulse can be used to cause ejection or for other operations.

It is also possible to signal the carriage to move the form (by skipping) through the distance marked by arm 2.

Arm 1 is normally set at the point on the scale representing the distance from the first printing line in the heading to the first printing line in the body of an invoice or similar form that is divided into two or more sections. In Figure 68, this distance is 1-1/2 inches. The carriage can be signalled to move the form (by skipping) through the distance marked by the arm 1 setting. Whenever the form has been moved (by line spacing) through the distance marked by arm 1, an impulse is available that can be used to control other functions of the carriage or accounting machine.

Sheet Length Adjustment

Arm 3 should be adjusted to equal the length of the sheet, as follows:

1. Loosen clamp nut A (Figure 68) several turns, using the special wrench for this purpose.
2. Insert the pinioned end of this wrench in the hole X, turning it slightly, if necessary, to mesh properly with the teeth of the scale Y.
3. Press the wrench inward slightly, and rotate it in the direction required to move the arm 3 index to the proper point on the scale.
4. Remove the wrench and tighten the clamp nut A. If arm 3 is set beyond 3-2/3 inches, make sure that the speed knob is set at medium (or long).
5. Close the drive unit door and pull the manual space-eject lever forward, in order to restore the mechanism to the new setting.

Speed Adjustment

Each time the sheet length adjustment is changed, the speed adjustment should be checked. An interlock prevents the carriage from operating if the speed adjustment is for a form shorter than that for which the sheet length adjustment has been made.

As an example, medium speed is disengaged and short speed engaged as follows:

1. Turn the carriage motor off by opening the drive-unit door.
2. Press the medium gear shift button in.
3. Rotate the interlock knob until the word *short* appears in the other opening.
4. Pull the short gear shift button out, turning the motor knob if necessary in order to mesh the gears.

Arm 2 Adjustment

Arm 2 is normally used to locate the last printing line, by being set to a point on the scale corresponding to the distance from the first printing line to the last printing line. When the carriage is set for double or triple spacing, this arm should be set for an even multiple of 2 or 3 line spaces, respectively. Also, when totals of listed items are to be printed, arm 2 should be set to provide for one or two additional total lines that may be required below the last normal printing line.

The last printing line adjustment should be made only after the proper sheet length adjustment has been completed. It is made as follows:

1. Pull the manual space-eject lever forward to cause ejection, and restore the mechanism.
2. Loosen the clamp nut B.
3. Move arm 2 to the index point corresponding to the distance from the first printing line to the last printing line.
4. Tighten clamp nut B.

For single-item ejection and other operations not requiring arm 2 controls, arm 2 may be set at any convenient point.

Arm 1 Adjustment

When heading cards are used, arm 1 is normally used to locate the first body line. When heading cards are not used, it may be placed at any convenient point. Arm 1 indicates the distance from the first printing line, which is the first heading line when heading cards are used, to the first body line. When the carriage is set for double or triple spacing, this distance should be a multiple of 2 or 3 line spaces, respectively. The arm 1 adjustment should be made only after arm 3 has been adjusted. It is made as follows:

1. Pull the manual eject-space lever forward to cause an ejection and restore the mechanism.
2. Loosen clamp nut C.
3. Move arm 1 until its indicator is set on the scale at the point corresponding to the distance from the first printing line to the first body line.
4. Tighten clamp nut C.

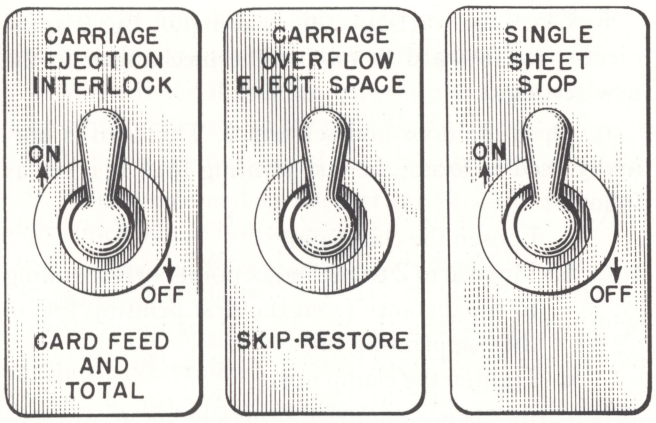


FIGURE 69. SWITCHES

Starting Line Dial

The starting line dial is used for single-sheet operation. It is set by loosening the locking screw, raising the locking lever, and turning the dial until the scale reading, indicated by the locking lever, is equal to the required distance from the top of the sheet to the first printing line. Lower the locking lever and tighten the screw.

SWITCHES

THE SWITCHES illustrated in Figure 69 supplement the control panel wiring in controlling operation of the automatic carriage. They have the following functions:

Carriage Ejection Interlock

This switch is effective only when the carriage is set for short-sheet ejection. Otherwise, the switch may be disregarded, as interlocking is automatic.

On short-sheet ejection, the switch must be turned on if either of the following conditions is present:

1. The carriage is wired for ejecting before and after a total.
2. The carriage is wired for successive ejection with heading card control.

If neither condition exists, the switch may be turned off for faster operation.

Carriage Overflow

This switch should be set to EJECT-SPACE when heading cards are being used. When heading cards are not being used, it should be set to SKIP-RESTORE if it is important that printing on overflow sheets begin at the first printing line. If ejecting speed is the more important factor, the switch should be set to EJECT-SPACE. When the switch is set to EJECT-SPACE and an overflow occurs, the ejection is followed by two line spaces. The two extra spaces are obtained only on overflow ejection when the switch is set to EJECT-SPACE.

When the switch is set to SKIP-RESTORE and an overflow occurs, the operation is overflow skipping (high-speed line spacing) from the last printing line on one form to the first printing line on the succeeding form, followed by restoration of the mechanism.

Single-Sheet Stop

This switch is provided to facilitate manual insertion of single sheets. When on, it stops the accounting machine as the sheet is ejected. Automatic operation is resumed by depression of the start key when the new sheet is inserted.

Automatic Form Stop

An automatic form stop lever in back of the platen stops the accounting machine when the carriage runs out of forms. Forms must overlap the center of the platen to use this feature. The automatic stop is made operative by an on-off switch. A second form-stop switch can be set to stop the accounting machine in one of two ways: IMMEDIATE—stops immediately after listing a line or immediately after printing the total for a line approximately 3-3/4 inches from the edge of the last form; EJECT—stops after an ejection. Operation can be continued by depressing the start key.

OPERATING POINTERS

WHEN SETTING the carriage arms, make sure that they are set exactly on the desired point on the scale.

Make sure that the eject-clutch button is disengaged when setting the arms.

Be sure to restore the carriage before setting the arms. This is especially important before setting arm 2.

When the speed knobs do not pull out readily, turn the motor knob manually with one hand and pull out the speed knob with the other. Turning the motor knob helps mesh the gears.

Be careful when tightening the clamp nut on the carriage. Too much tightening may break the ends of the wrench.

The carriage motor will not start if arm 3 is set beyond 3-2/3 inches, and the speed adjustment is set for short speed.

If arm 3 cannot be moved freely by hand, toward *0* on the scale, it can be moved either by line spacing (pushing the manual eject-clutch button backwards) or by using the pinioned end of the wrench, as described in step 2 under sheet length adjustment.

The platen should be raised, before paper is inserted, by depressing the platen turnover lock and pulling the platen turnover handle. One turn of the platen knob is sufficient to feed the paper between the pressure rolls and the platen.

For single-sheet operations, if the starting line dial is set properly, the rotation of the platen turnover handle back to its normal position causes the paper to be drawn in to the proper place, ready for operation.

Be sure that the carriage door is closed before beginning an operation. The accounting machine will not run if the carriage door is open.

HOW TO OPERATE THE AUTOMATIC CARRIAGE

1. Turn on the main-line switch of the accounting machine.

2. Open the carriage door and disengage the eject-clutch button.

3. Set arm 3 at a point equal to the over-all length of the form as follows:

   a. Loosen the clamp nut, using a special wrench.
   b. Move the arm to the proper point on the scale by using the pinioned end of the wrench.
   c. Tighten the clamp nut.

4. Check the speed adjustment knobs. If arm 3 is set at 3-2/3 inches or less, the short speed knob should be pulled out. If the setting is greater than 3-2/3 inches, the medium (or long) speed knob must be pulled out. An example of changing from medium to short is as follows:

   a. Press the medium speed knob in.
   b. Rotate the interlock knob until the word *short* appears in the other opening.
   c. Pull the short speed knob out.

5. Close the carriage door, and pull the manual eject-space forward to restore the mechanism to the new setting.

6. Open the door and set arm 2. This arm is normally used to locate the last printing line. It is set as follows:

   a. Loosen the clamp nut.
   b. Move arm 2 to the index point corresponding to the distance from the first printing line to the last printing line.
   c. Tighten the clamp nut.

When arm 2 is not required, it may be set at any convenient point.

7. Arm 1 is normally used to locate the first body line. It is set as follows:

   a. Loosen the clamp nut.
   b. Move arm 1 to the index point corresponding to the distance from the first printing line to the first body line.
   c. Tighten the clamp nut.

When arm 1 is not required, it may be placed at any convenient point.

8. Close the carriage door, and restore the carriage.

9. Raise the platen by pushing the platen turnover lock and pulling forward on the platen turnover handle.

10. Feed the forms so the first one catches between the pressure rolls and the platen.

11. Lower the carriage.

12. Adjust the carriage laterally by means of the carriage shift handle.

13. Adjust the paper vertically by means of the adjusting knobs.

14. If the platen needs to be turned back, depress the clutch release lever while turning the platen.

15. Set the space adjustment to single, double, or triple line spacing.

16. Engage the eject-clutch button. The machine is now ready to operate.

REVIEW QUESTIONS

1. What is the purpose of the carriage?
2. What is a short form and what speed can be used?
3. Why should the carriage door be closed when the accounting machine is to be operated?
4. How is the platen raised so that forms may be inserted?

5. May the carriage be moved laterally? If so, how?

6. How is the scale in the carriage divided?

7. What is the difference between the small and the large adjusting knobs on the right end of the platen?

8. What is the purpose of the pressure release lever?

9. What function does the carriage perform when the eject-clutch button is disengaged?

10. In what position must the eject-clutch be when the carriage is being used?

11. For a manually inserted form, what does the starting line dial determine?

12. How can the platen be turned backwards when the large adjusting knob is being used?

13. How can a report be double spaced?

14. What happens to the carriage when the manual eject-space lever is pulled forward? Pushed backward?

15. What is the function of arm 3? How is it set?

16. What is the function of arm 2? How is it set?

17. What is the function of arm 1? How is it set?

18. What part of the carriage is used to make the proper speed adjustment?

19. What prevents the carriage from operating if the speed adjustment is for a form shorter than that for which the sheet length adjustment has been made?

20. When double or triple spacing, what rule should be followed when arms 1 and 2 are being set?

IBM TAPE-CONTROLLED CARRIAGES AND FORM-FEED DEVICES

TAPE-CONTROLLED CARRIAGE, TYPE 923

THE TAPE-CONTROLLED CARRIAGE controls feeding and spacing of forms at high speed while documents or reports are being prepared on Type 402 and Type 403 Accounting Machines. This carriage is controlled by punched holes in a narrow paper tape that exactly corresponds in length to the length of one or more forms. Holes punched in the tape stop the form when it reaches any predetermined position.

The carriage will accommodate continuous forms measured in 6ths of an inch up to a maximum of 22 inches in length and 19-1/2 inches in width, including punched margins.

Forms can be designed to permit printing in practically any desired arrangement. Skipping can be controlled to 8 different sections of the form.

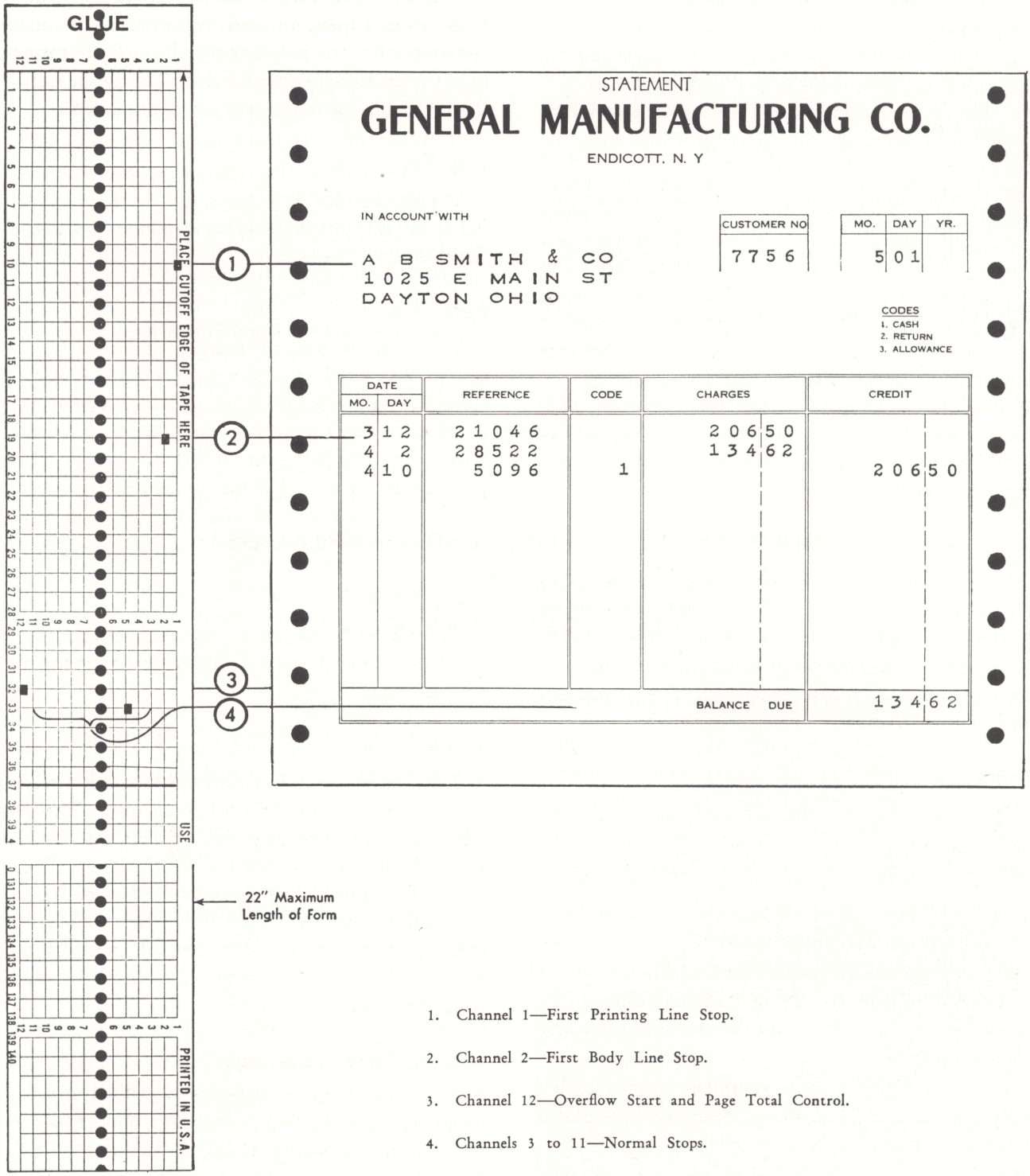
Single, double, or triple spacing can vary between lines as controlled by wiring on the control panel.

Overflow Skipping

When one form is completely filled, it is ejected, and the next form is advanced to the first printing line or to the first body line. This overflow skipping is caused by sensing a punch in a specific position of the tape, which starts advancing the paper to the required line on the next form. If the last card of a group prints on the last available detail printing line, the total will print before skipping to the next form takes place.

Predetermined Total Line

Any class of total can be printed on a predetermined line, whether the form is completely filled or not. For example, although only two or three items have printed on a form, the total of these items may be printed at the bottom of the form instead of directly beneath the last item printed.



1. Channel 1—First Printing Line Stop.
2. Channel 2—First Body Line Stop.
3. Channel 12—Overflow Start and Page Total Control.
4. Channels 3 to 11—Normal Stops.

FIGURE 70. CONTROL TAPE

OPERATING FEATURES

Control Tape

The control tape (Figure 70) has 12 columnar positions indicated by vertical lines. These positions are called *channels*. Holes can be punched in each channel throughout the length of the tape. A maximum of 132 lines can be used for control of a form, although for convenience, the tape blanks are slightly longer. This will allow form depths of 22 inches when 6-lines-to-the-inch spacing is used. All forms 3-2/3 inches in depth or less are considered *short forms*. Round holes in the center of the tape are prepunched for a pin-feed drive in a tape sensing mechanism that controls the carriage. The tape advances through the mechanism in synchronism with the movement of a printed form through the carriage. The effect is exactly the same as though the control holes were punched along the edge of each form.

Platen Clutch

When the arrow on the platen clutch is pointing upward, as shown in Figure 71, the platen is engaged and can be turned manually only by the vernier knob. To disengage the platen from machine control, the platen clutch is turned to the right. The platen can then be turned manually by the platen knob.

Restore Key

The carriage is set at the start or home position by depressing the restore key. This is done while the platen is disengaged. Restoring is necessary because the distance that each form travels through the carriage, as it is being printed, is measured by the tape. Starting from the first printing line of one form, the tape moves in synchronism with the form, until the first printing line of the next form is reached.

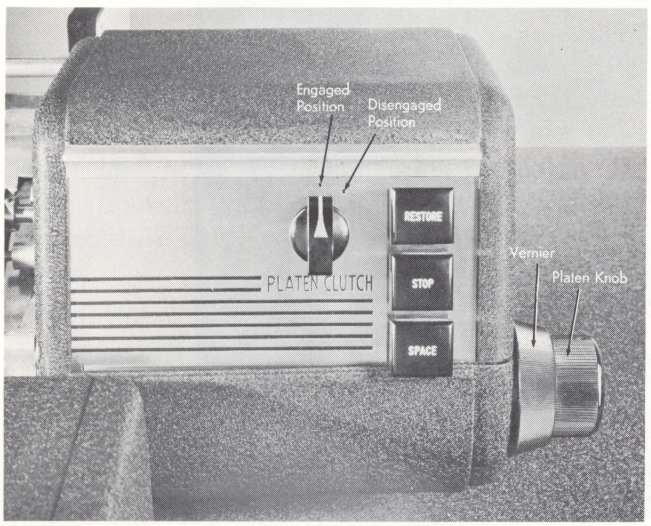


FIGURE 71. TAPE-CONTROLLED CARRIAGE

Stop Key

Depressing this key stops the carriage operation instantly, and the accounting machine at the end of the cycle.

Space Key

When the accounting machine is stopped, a form can be advanced by depressing the space key. The form advances one space for each key depression, regardless of the spacing for which the space control is wired. The first form can be fed into position by depressing the space key if the platen clutch is engaged, but the platen clutch should then be disengaged to permit restoring the tape without advancing the form.

Platen Knob

The platen knob can be turned backward or forward to position the form only when the platen clutch is disengaged.

Vernier Knob

The vernier knob is used to obtain exact registrations in relation to the horizontal lines. The platen advances, thus lowering the printing on the form, when the knob is turned counterclockwise. Turning the knob in a clockwise direction will cause the printing to occur higher on the form. In either case, the carriage tape is not affected, and adjustments can be made while the platen is engaged or while the machine is in operation.

Inserting Tape in Carriage

The cover of the carriage is tilted back to gain access to the tape reading mechanism. The platen clutch is turned to a disengaged position, and the brushes are raised by moving to the left the latch located on the side of the brush holder. The tape ends are glued together to form a loop. *With the tape held so that the printed captions can be read,* one end of the loop is placed over the pin-feed drive wheel so that the pins engage the center drive holes. The opposite end of the loop is placed around the nearest half-circle guide

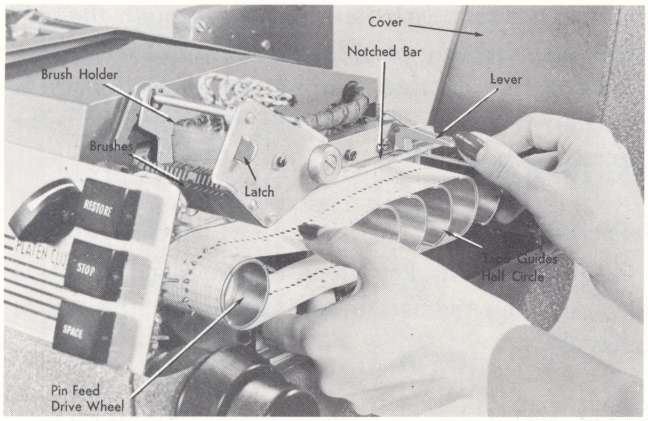


FIGURE 72. INSERTING TAPE IN CARRIAGE

piece. The excess slack is removed from the tape by lifting the lever away from the notched bar and by moving the guide piece unit to the right. The tape should be just tight enough so that it will give slightly when the top and bottom portions of the loop are pressed together as shown in Figure 72. It should not fit too tightly or the pin-feed holes will be damaged.

After the tape is in position, the brushes are pressed down and the cover is closed. The restore key is depressed to bring the tape to its home position, and the platen clutch is turned back to the engaged position. The carriage is then ready to operate.

Form Feed

As in a typewriter, the first form is placed on the paper table and advanced into printing position by turning the platen knob. The carriage need not be moved in any way except for minute adjustments in horizontal registration and vertical alignment.

Platen

The carriage can be equipped with an IBM Pin-Feed Platen device or a solid platen assembly for use with an IBM Forms Tractor, or approved feeding devices of other manufacturers.

Either the pin-feed or the solid platen assembly may be easily removed (Figure 73) by raising the platen lock on the left side, pulling the assembly to the left and lifting it from the platen bearing housing. When the platen assembly is inserted, the end with the gear wheel should be placed in the slot on the right of the carriage and the left end should be dropped into the platen bearing housing. The platen assembly must then be moved to the right, turning it back and forth in order to fit the platen drive key into the carriage drive mechanism. The platen lock is then closed.

If pin feeding is not desired, the pins may be made inoperative by turning the pin positioning disc clockwise.

The removable platen sectors are either split or tubular and are available in varying sizes to accommodate forms of different widths. Split sectors may be easily removed by loosening the sector release, shifting it to the right and pulling the two sectors apart. To remove the tubular type of platen sector the left platen bearing and tightening nut must be pulled from the shaft.

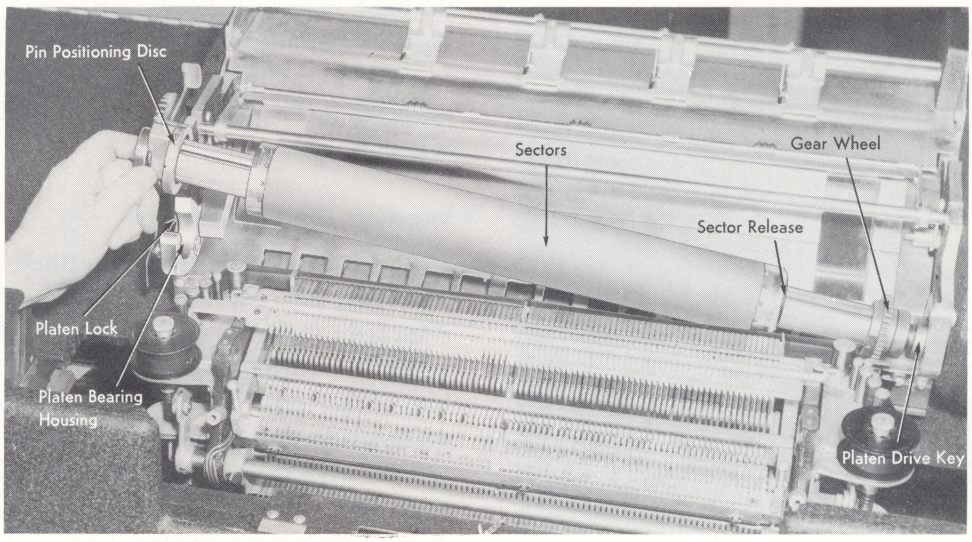


FIGURE 73. PLATEN

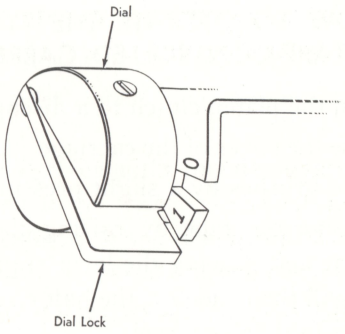


FIGURE 74. FORM THICKNESS ADJUSTMENT DEVICE

Form Thickness Adjustment Device

The distance between the typebars and the platen is adjustable for thickness of paper stock or for varying number of copies, by the use of the form thickness adjustment device (Figure 74) located under the covers between the brushes and the print unit. This device contains 7 notches numbered from 0 through 6. When the dial is in the 0 notch, the typebars are 1/8 (.125) of an inch from the platen. When the dial is set to 6, the distance is increased to approximately .178 of an inch. The dial should be set wherever the best results are obtained. To adjust for varying thicknesses, the dial lock is pulled out, and the dial is turned clockwise to increase the distance between the typebars and the platen, and counterclockwise to decrease the distance.

Paper Brake and Form Stop Device

In back of the platen is a paper brake device (Figure 75), for adjusting the drag or tension on the paper. As a part of the brake device, there are four form stop controls that stop the machine when the carriage runs out of paper. Forms feed under the form stop controls. When the bottom edge of the last form passes the form stops, all four form stops drop into slots as shown, and the machine stops. The distance between these stops and the printing line is about ten inches.

Both the paper brake and form stop control are made operative, separately or together, by a lever at the left side of the carriage. When the lever is in the top notch, as illustrated, both the paper brake and form stop are operative. When the lever is in the middle notch, the paper brake device is OFF and the form control is ON. When the lever is in the bottom notch, the paper brake and the form control are OFF.

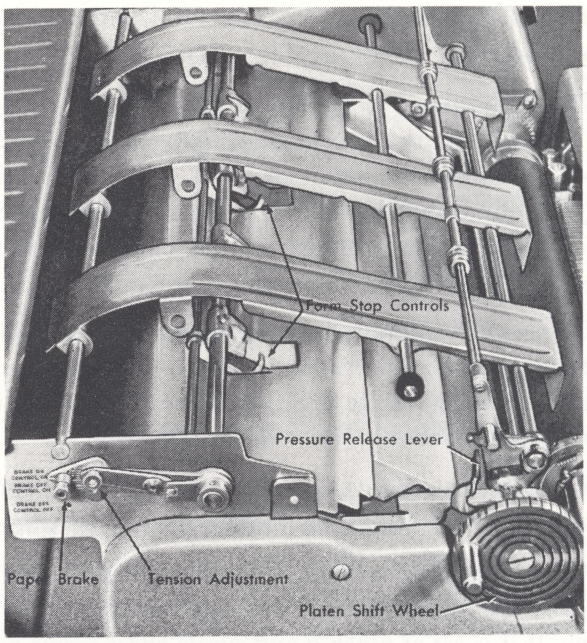


FIGURE 75. OTHER CARRIAGE FEATURES

Tension Adjustment

The drag on a form may be increased or decreased to obtain the best operation for a specific form, by regulating the tension adjustment lever located on the outside of the paper brake device. The lever may be set in one of four positions above the middle line on the dial to decrease tension, or in one of four positions below the middle to increase tension.

Pressure Release Lever

When this lever is pushed backward, the feed rolls are released so that the paper can be moved freely around the platen. Pressure should always be released when form feeding devices are in use. Pressure should be applied when form feeding devices are not in use.

Platen Shift Wheel

The platen may be shifted laterally a total of six inches to the left or right by turning the platen shift wheel. This adjustment can be made while the machine is in operation.

OPERATING POINTERS

THE PLATEN CLUTCH should be in a disengaged position (turned to right) while the tape is being inserted

in the carriage, and especially when the restore key is depressed.

The tape must be inserted in the carriage so that the printed captions can be read. After inserting the tape, excess slack should be removed. The tape should be just tight enough so that it will give slightly when the top and bottom portions of the loop are pressed together.

Be sure that the brushes are clamped in position after tape is inserted. Failure to do so will cause continuous running of the tape when the restore key is depressed, or when the first skip occurs.

When the carriage is not in use, the brushes should be clamped tightly against the pin-feed drive wheel.

Be sure that the form thickness device is set properly for the forms that are feeding through the machine. If it is set at notch 6 and single-sheet forms are feeding, printing may not take place. This is because the platen is too far away from the typebars.

The pressure release lever should be pushed backward when form feeding is accomplished by pin wheels. It should be pulled forward when form feeding is accomplished by pressure rolls.

If a report form contains an identification mark (▲), the report should be positioned in the carriage so that the identification mark lines up with the ribbon guide on the machine.

Tapes should never be folded at the ends because the tape tends to overlap at the creases when traveling around the pin-feed drive wheel.

Be sure that the forms are fed under the form stop controls and not over them.

Do not use the stop button on the carriage to stop the accounting machine. Although this button will stop both the accounting machine and the carriage, it is not intended to be used in place of the regular accounting machine stop key.

The platen cannot be turned backwards unless the platen clutch is in a disengaged position.

Make sure that the carriage is restored and the platen clutch is engaged before an operation is begun. Failure to restore causes improper spacing of the forms; failure to engage the platen causes all printing to take place on the same line.

HOW TO OPERATE THE TYPE 923 TAPE-CONTROLLED CARRIAGE

1. Turn the platen clutch to a disengaged position.
2. Raise the cover of the carriage.
3. Raise brushes by a slight pressure on the latch.
4. Remove the tape by raising the lever on the notched bar and moving the lever slightly to the left. The tape will then slide off the half circle guide pieces and the pin-feed drive wheel.
5. Insert the new tape as follows:
   a. Hold the tape so that the printed captions can be read.
   b. Loop one end over the pin-feed drive wheel so that the pins engage the center drive holes.
   c. Place the opposite end of the loop around the nearest half-circle guide piece.
   d. Remove excess slack by lifting the lever away from the notched bar and by moving the guide piece to the right. The tape should be just tight enough so that it will give slightly when pressed together.
6. Clamp the brushes in position.
7. Close the door.
8. Depress the restore key.
9. Push the pressure release lever backward.
10. Place the paper brake in the bottom notch (brake OFF, control OFF).
11. Feed the forms from the back of the machine under the form stop controls and under the platen, until the end of the form can be grasped by the hand.
12. Adjust and align the form according to the type of form-feed device used. If no form-feed device is used, straighten and align the form around the platen.
13. Locate the first printing line on the forms, and position the line so that it is just barely covered by the ribbon. It may be necessary to start with the second form.
14. Replace the paper brake in either of the two top notches, according to instructions from the supervisor.
15. Pull the pressure release lever forward if the pin wheels are not used; otherwise, leave it pushed back.
16. Depress the restore key once more.
17. Close the cover.
18. Turn the platen clutch to its engaged position.
19. Depress the start key to begin the operation.

REVIEW QUESTIONS

1. What is the purpose of the tape-controlled carriage?
2. How is single, double, and triple spacing controlled?
3. What is the purpose of the round holes in the center of the tape?
4. What direction must the platen clutch be pointing before the platen can be moved manually?
5. How is the carriage set at the start or home position?
6. Which way should the tape face while it is being inserted in the carriage?
7. How are the brushes lifted away from the pin-feed drive wheel?
8. How tight should the tape be for most efficient operation?
9. Can a tape be used more than once?
10. What is the purpose of the form-thickness adjustment device?
11. What happens when the last form passes the form stop controls?
12. In what position must the pressure release lever be so that the paper can be moved freely around the platen?
13. The platen can be shifted laterally six inches to the left or right. How is this done?
14. Can the platen be shifted while the machine is in operation?

FORM-FEEDING DEVICES FOR USE WITH THE TYPE 923 TAPE-CONTROLLED CARRIAGE

Forms can be fed through the Type 923 carriage by one of the following methods:

1. IBM Pin-Feed Platen Device (Model P-2 or P-3).
2. IBM Forms Tractor (Model F-3)
3. Feeding devices of other manufacture.

IBM PIN-FEED PLATEN DEVICE

The IBM Pin-Feed Platen (Figure 76) advances forms by means of the retractable pin-feed mechanisms located on each end of the platen. As the platen and pin wheels revolve, the pins engage in the marginal holes of the forms and pull the forms forward and up, thus advancing the forms without the use of pressure rollers.

To obtain continuous accurate form alignment when the IBM Pin-Feed Platen is being used, the pressure rollers on all IBM carriages *must be in the inoperative position.* The pins alone *must* control advancing of forms. The forms *must* also flow under the platen and out of the carriage without undue pull, drag, or interference of any kind.

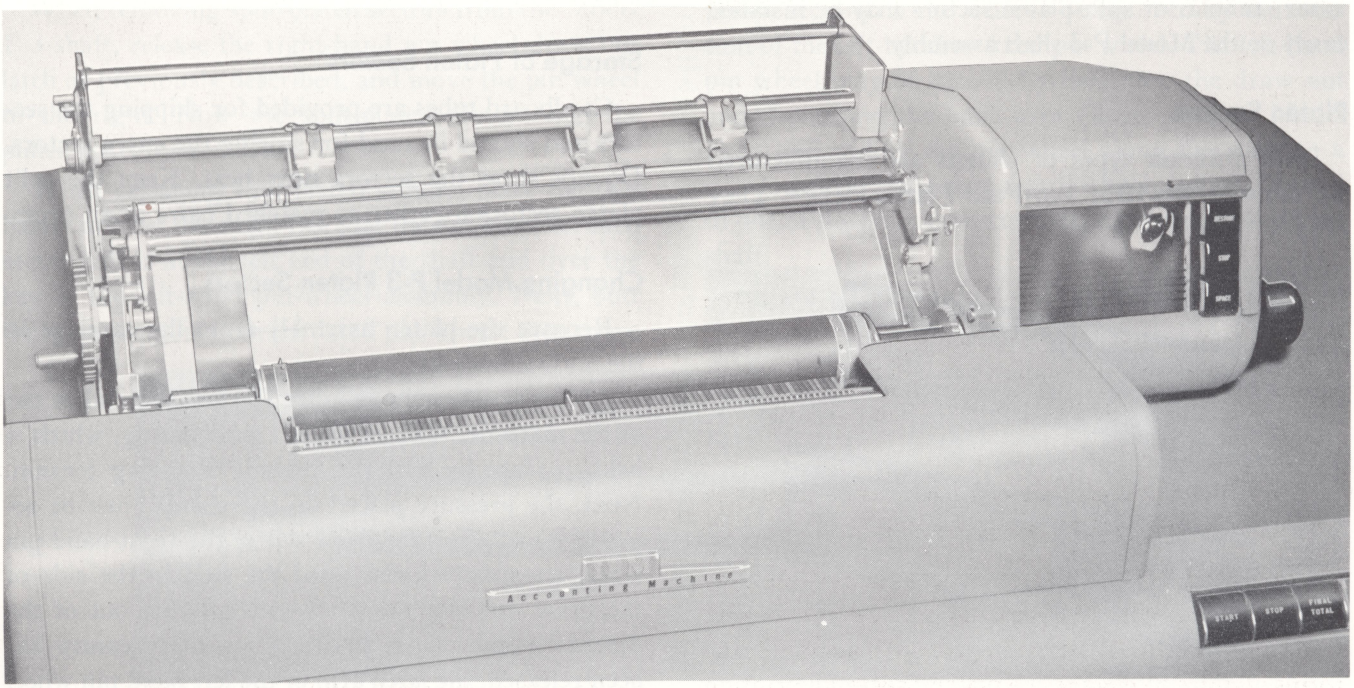


Figure 76. Pin-Feed Platen

The operator can change all operations and functions of the platen without the use of tools. The distance between the pin wheels is changed to fit any width form by replacing the platen with one of the proper length. The lateral position of the platen on the shaft is determined by the location of the left-hand, or fixed, pin wheel. The retractable pin wheels may be shifted to the inoperative position so that the pins emerge at the rear rather than the front of the platen when friction-feeding forms.

The IBM Pin-Feed Platen does not detract in any way from the general utility of the machines with which it is used. Friction-fed forms and above platen form-feeding devices may still be used whenever desirable. Forms without marginal holes, or paper of a shorter width than the platen may be friction-fed without making any changes. However, when forms the same size as the platen are to be friction-fed or fed by an above-platen feeding device, the pin wheels must be shifted to the inoperative position. Any size platen may be used this way, provided the form is not wider than the platen. Type characters should never be allowed to print against, or directly strike, the metal pin wheels.

The IBM Pin-Feed Platens (Model P-2 and Model P-3) are interchangeable with each other in any Type 923. However, the earlier model (Model P-2) shaft assembly will accommodate only split-platen sectors. Either tubular or split-platen sectors may be installed easily on the Model P-3 shaft assembly.

Platen Sectors

Two different types of platens are manufactured for use with the IBM Pin-Feed Platen Device. They are:

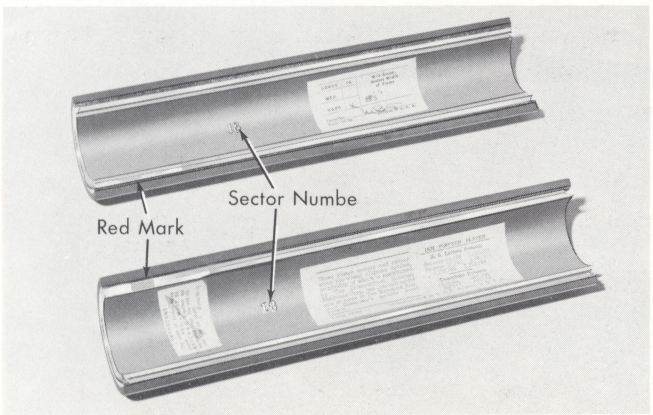


FIGURE 77. SPLIT-PLATEN SECTORS

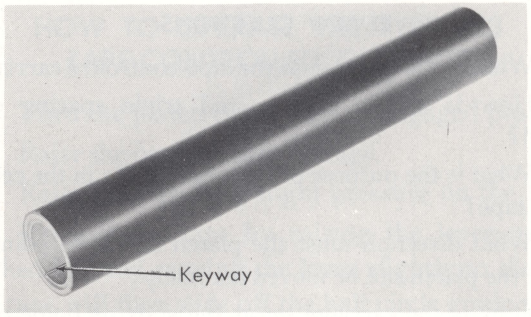


FIGURE 78. TUBULAR PLATEN SECTOR

1. The two-piece split platen shown in Figure 77.
2. The one-piece tubular-type platen shown in Figure 78.

Split-platen sectors are split lengthwise into two halves. Changing the platens is thus simplified on machines with the non-removable-type platen shaft assemblies. These sectors are manufactured as matched pairs and should be used as such. An identifying number is stamped on the inner core of each sector half; therefore, the sectors are a matched pair when the numbers agree. Each sector half also has a red mark painted on one corner of the inner metal sleeve. The sector halves fit together properly only when these marks touch each other.

Tubular platens are designed for use with the platen shaft assemblies that may easily be removed from the machine by the operator.

Storage of Platen Sectors

Cardboard tubes are provided for shipping the sectors and should be used for storing the extra sectors. Do not store the sectors near heat. Keep the split platen sectors together as matched pairs at all times.

Changing Model P-3 Platen Sectors

Remove the platen assembly from the carriage in the normal manner.

After the assembly (Figure 79) has been taken out of the machine, remove the left end bearing, which is held in place by a slight amount of spring tension. Next, the pressure placed on the platen must be released by rotating the draw nut of the right-hand pin wheel counterclockwise until the stud in the side of the draw nut lifts the draw nut latch up out of the threads in the platen shaft. When the pressure has been released, the latch arm of the left-hand pin wheel may be depressed and the assembly will slide off the

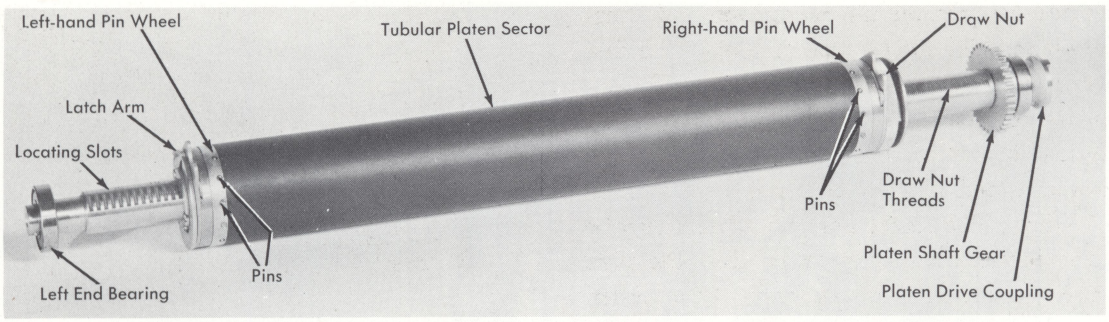


FIGURE 79. MODEL P-3 PIN-FEED PLATEN

shaft. The tubular platen sector may then be removed from the left end of the shaft.

To re-assemble the pin-feed platen, place the tubular sector, left-hand pin wheel and left-hand bearing on the shaft in that order. Next bring the tubular sector up against the left pin wheel; then slide the right pin wheel to the left, aligning the key with the keyway of the platen. When the right pin wheel is as tight against the platen as possible, rotate the draw nut clockwise so that the stud will allow the draw nut latch to engage with the threaded portion of the platen shaft. Turn the draw nut as tight as possible. A wrench is provided to facilitate this operation. Place the platen on the reading board with the wrench engaged and under the platen, and turn the platen with both hands, thus tightening it against the wrench.

When removing split-platen sectors from the Model P-3 shaft, release the right-hand pin wheel draw nut latch as previously described, and move the pin wheel to the right. Now the split-platen sectors may be pulled apart for removal.

When replacing split-platen sectors, place the two halves around the shaft. See that the *red mark* on each sector half is at the left end of the shaft and over the key in the left-hand pin-wheel assembly. Next, butt the sectors against the left-hand pin wheel; then move the right-hand pin wheel in position, and tighten as previously described.

Changing Model P-2 Platen Sectors

The Model P-2 shaft assembly (Figure 80) is designed with a non-removable left-hand bearing and pin wheel; therefore, this model accommodates only split-platen sectors.

When removing or installing platen sectors on the Model P-2, follow the procedure previously described for removing and installing split-platen sectors on the Model P-3.

Positioning Platen on Shaft

A platen sector may be located laterally to align the form with the typebars. The lateral position of the platen sectors on the shaft is determined by the location of the left-hand or fixed pin wheel. The left-hand pin wheel may be moved by loosening the draw nut and depressing the latch arm (latch plate on Model P-2) and sliding the pin wheel along the shaft to a new location. Make sure that the latch is firmly seated in one of the large crosscut locating slots in the platen shaft.

Figure 80 shows the location of the latch plate on the Model P-2 pin-feed assembly.

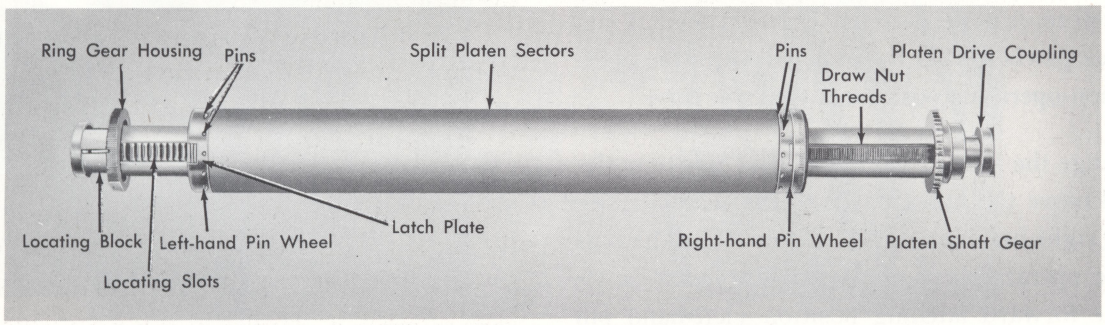


FIGURE 80. MODEL P-2 PIN-FEED PLATEN

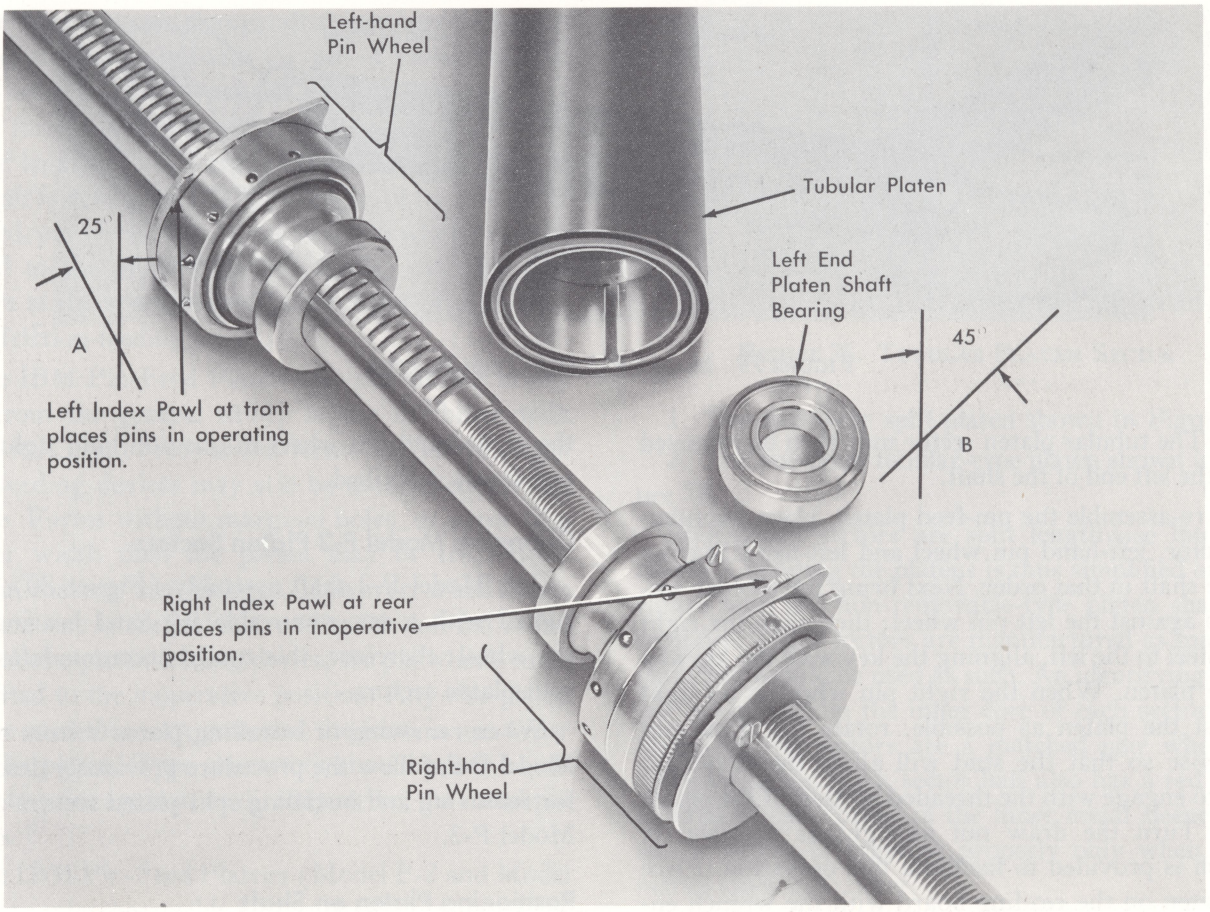


FIGURE 81. MODEL P-3 PINS IN OPERATING AND INOPERATIVE POSITION

Figure 81 shows the location of the latch arm on the Model P-3 pin-feed assembly.

Changing the Position of the Pins on Model P-3

The Model P-3 platen shaft assembly is designed so that each pin wheel operates as an independent assembly. Therefore, it is necessary to position the left and right index pawls so that the pins will be in the operating or non-operating position at the same time.

To change the pins to the inoperative position, depress and move the index pawls to the rear latching position (right-hand pin wheel, Figure 81). The pins are in the operating position when the index pawls are in the forward latching position (left-hand pin wheel, Figure 81).

Changing Position of the Pins on Model P-2

The Model P-2 shaft assembly is designed so that the operating position of the pins in both pin wheels is changed simultaneously.

The pins are placed in the operative position by pulling outward on the locating block key and rotat-

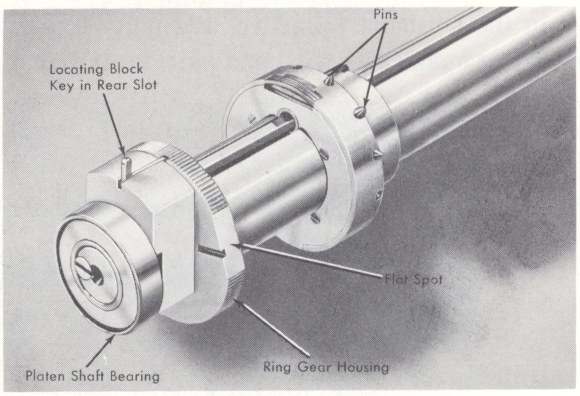


FIGURE 82. MODEL P-2 PINS IN THE OPERATING POSITION

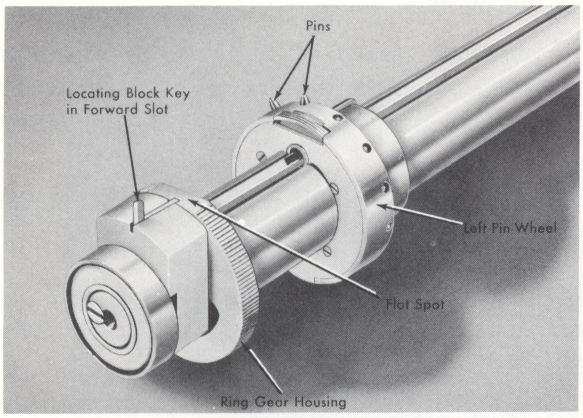


FIGURE 83. MODEL P-2 PINS IN THE INOPERATIVE POSITION

ing the ring gear housing until the key can be placed in the rear slot in the ring gear housing. This causes the pins of the pin wheel to emerge in the operative position at approximately the front of the platen (Figure 82).

The pins are placed in the inoperative position by pulling outward on the locating block key and rotating the ring gear housing so that the key can fall into the slot in the ring gear housing at the flat spot (Figure 83). This causes the pins of the pin wheels to emerge at a point near the top of the platen.

Tear Bar Position

The carriage tear bar rollers may be raised off the platen when the pin-feed mechanism is in the operating position.

The tear bar adjusting lever, mounted on the left-hand arm of the tear bar, pivots forward and may be latched at three positions. When the lever is at the lowest position, the tear bar rollers rest on the platen. As the lever is raised, it causes the tear bar rollers to be raised farther off the platen for each succeeding latching position. The adjusting lever should be latched in the position that raises the rollers an amount corresponding to the thickness of the forms in use.

Form-Feed Guides

The upper form guides (Figure 84) are mounted on two shafts. The paper roll shaft extends through the rear set of holes in each guide. A front support shaft extends through the front holes, and rubber grommets are mounted on each end of this shaft to hold it in position.

Set the guides equidistantly across the carriage so that the center guide supports the center of the form, and the outer guides support the marginal edges of the form.

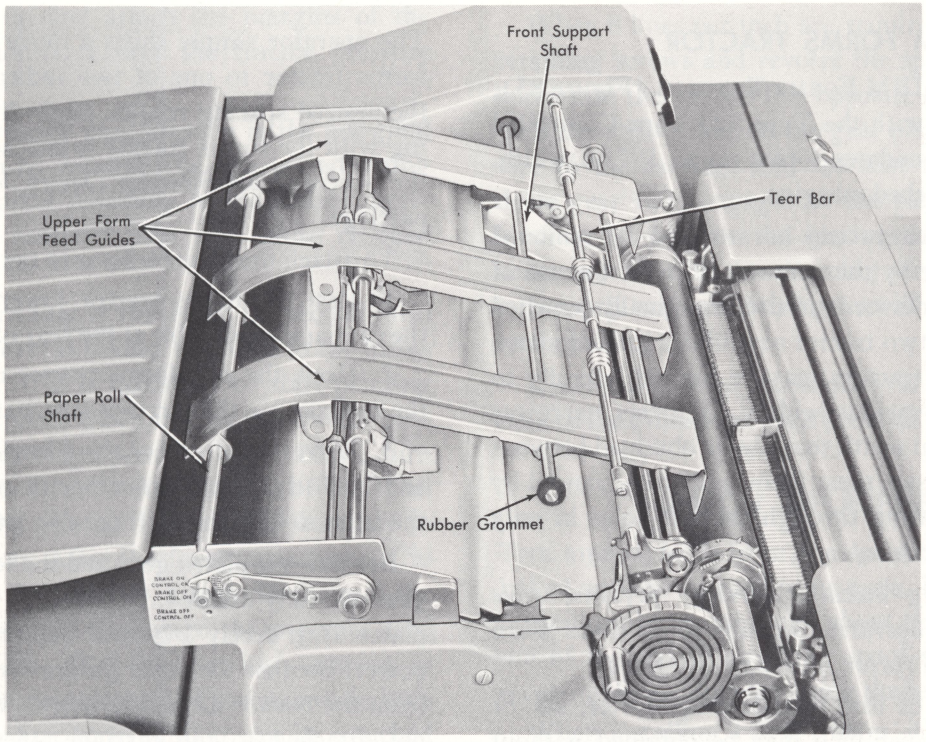


FIGURE 84. FORM FEED GUIDES

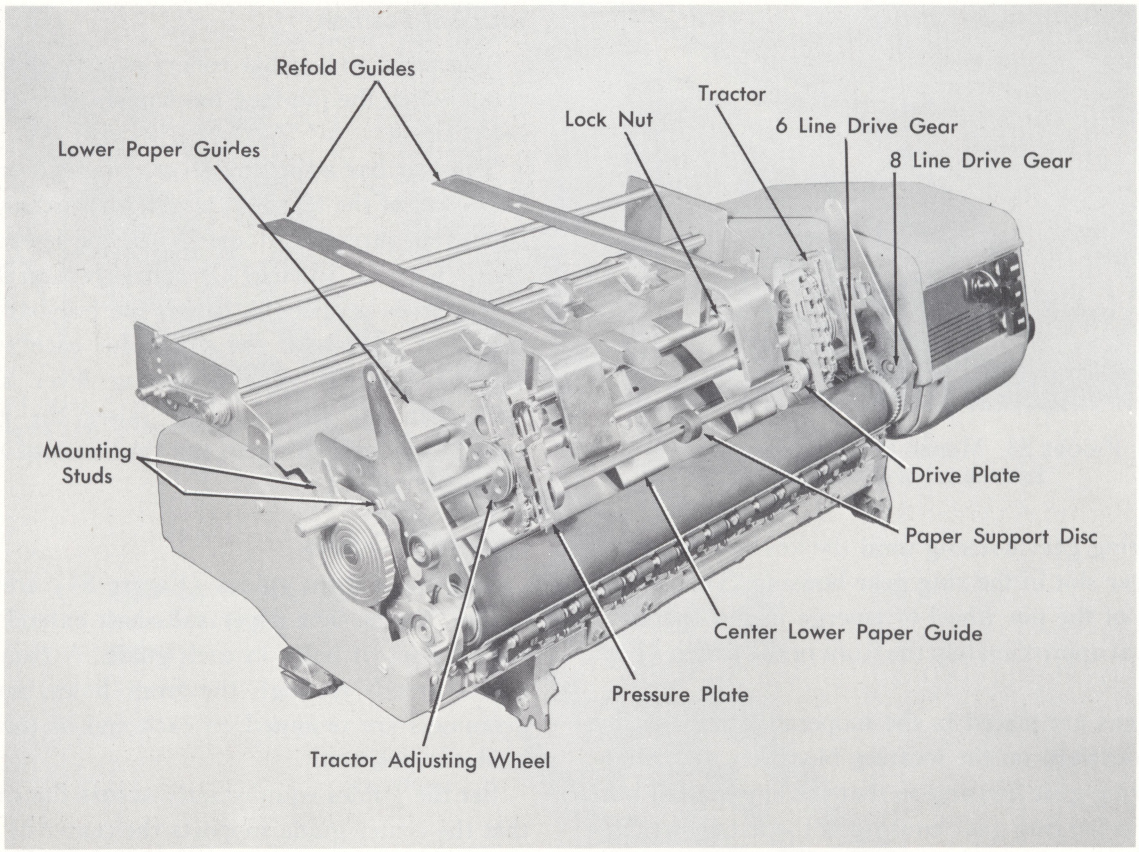


FIGURE 85. MODEL F-3 FORMS TRACTOR ON TYPE 923 TAPE-CONTROLLED CARRIAGE

IBM FORMS TRACTOR

THE MODEL F-3 IBM FORMS TRACTOR (Figure 85), designed for use with the Type 923 Tape-Controlled Carriage, accommodates forms up to 19″ in width, including the punched margins.

The forms tractors can be attached or removed from the carriage by the operator without the use of tools. When the device is in use, marginally punched forms are fed by two tractor assemblies located above the platen. Both tractors may be located laterally to accept forms of various widths. If forms narrower than the minimum width that can be obtained between the tractors are used, these forms may be advanced by one tractor operating through the pin holes in only one side of the form.

The accounting machine carriage pressure rolls must be in the inoperative position at all times when the IBM Forms Tractor is used to feed forms.

With the use of this form-feeding device, six or eight line spaces per inch may be obtained without altering the accounting machine carriage in any way. The operator simply shifts a drive gear plate on the forms tractor to one of two indicated positions for the desired spacing results. Eight-lines-per-inch feeding with the forms tractor is less accurate than with the special Line-Spacing Device for the Type 923 carriage.

To attach the forms tractor to the carriage:

1. Rest the forms tractor lower paper guides on the carriage paper table at the rear of the platen.

2. Hook the rear forms tractor mounting studs in the rear slots in the carriage side frames.

3. Lower the front of the forms tractor assembly, and latch the front forms tractor mounting studs in the front slots in the carriage side frames.

See that the platen gear and the forms tractor drive gear are fully meshed. Be sure the forms tractor and platen turn freely by hand before operating under power. Because the paper guides are free to disengage from the tractor adjusting wheels when the device is not attached to the carriage, these units must be guided into engagement.

When removing the device, reverse the foregoing procedure. The front forms tractor mounting stud latches are simply cammed out of the way as the front of the device is raised.

Steps in Using the Model F-3 IBM Forms Tractor

1. Loosen both lower paper guide lock nuts.
2. Move the left-hand paper guide and tractor laterally to the desired position and tighten that lock nut.
3. Insert forms over the lower paper guides and under the platen.
4. Move the right-hand paper guide and tractor in toward the form. Allow a slight amount of clearance between the form and the right- and left-hand guides so that forms will feed without binding. Tighten the right-hand paper guide lock nut.
5. Center the paper support disc between the tractor assemblies.
6. Locate the center lower paper guide midway between the outer paper guides.
7. Clip the refold guides onto the tractor guide rod and position them approximately midway between each tractor assembly.
8. With the carriage pressure rolls in the inoperative position and the tractor pressure plates raised, draw the forms up and attach the margins of the forms to the tractors. Lower the tractor pressure plates.
9. Center the tractor pins laterally in the marginal holes of the form by rotating the knurled adjusting wheel on each tractor assembly in the proper direction. Improperly centered pins may cause crooked feeding.
10. Usually, printing is started on the second form because the first form is needed to attach to the forms tractor. However, if it is necessary to start printing on the first form, place that form on the tractor pins and engage the carriage pressure rolls. Next, turn the platen backwards until the first line of the form is in position to be printed. Depress the start key to begin the operation. After the form has advanced to the tractors, stop the machine, attach the form to the tractor chain pins, and disengage the pressure feed mechanism. NOTE: If 8-lines-per-inch spacing is required, it will be necessary to adjust manually each line space on the first form until it can be attached to the tractor chain pins.

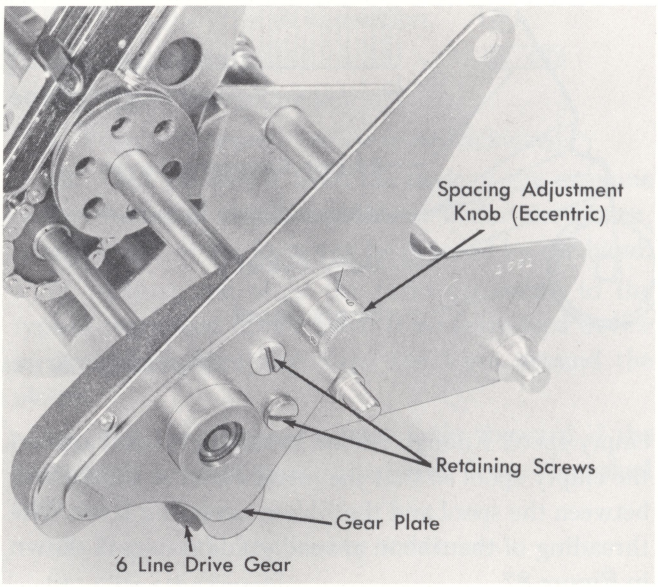


FIGURE 86. 6 OR 8 LINE DRIVE (MODEL F-3)

6- or 8-Line Drive

The 6 or 8 lines quick-change drive gear mechanism is shown at the 6-lines-per-inch setting in Figure 86. The scribed line alignment provides only a general drive gear to platen gear relationship. These lines may be moved away from each other in either direction to obtain proper gear mesh.

When 8 lines per inch are required, loosen the two retaining screws and revolve the spacing adjustment knob until the scribed line opposite the "8" is aligned with the scribed line on the gear plate. Attach the device to the carriage and see that the forms tractor drive gear fully engages in the platen gear without binding. Re-position the spacing adjustment knob if necessary. Be sure the retaining screws are tight. An improperly engaged drive gear will result in non-uniform spacing.

Reverse the above procedure to shift the mechanism back to the 6-lines-per-inch position.

RIBBON REPLACEMENT

THE RIBBON feeds from one spool to the other about 1/4 of an inch on each print cycle. It feeds in one direction until a metal eyelet about ten inches from the end of the ribbon on either spool strikes the ribbon reversing lever, thus reversing the feed.

When installing a new ribbon, it is important that the leading end of the ribbon is firmly hooked onto the

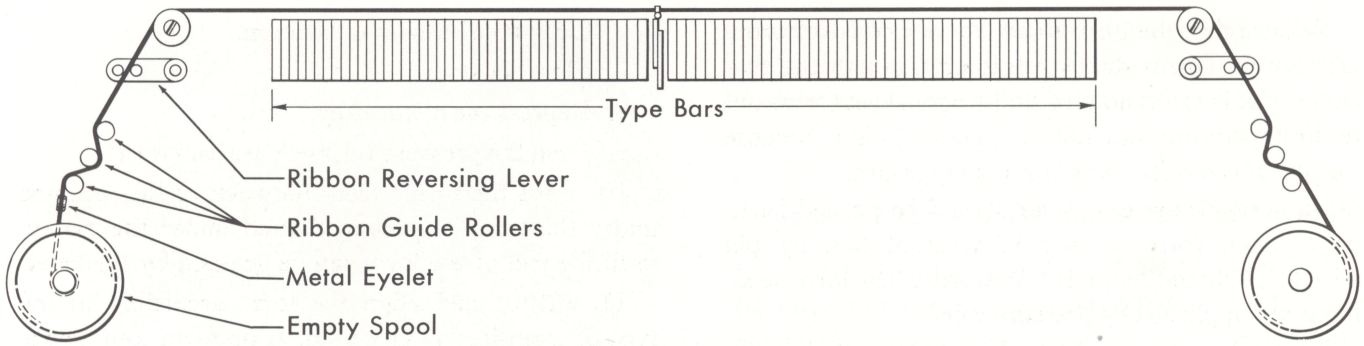


FIGURE 87. SCHEMATIC OF RIBBON FEED

empty spool. Enough ribbon should be wound around the empty spool so that the metal eyelet is somewhere between the spool and the ribbon reversing lever. The threading of the ribbon around guide rollers is shown in Figure 87.

TYPE 922 TAPE-CONTROLLED CARRIAGE

MECHANICALLY, the Type 922 Tape-Controlled Carriage is identical to the Type 923 and is used on the Type 407 Accounting Machine. There are, however, some operational differences that will be explained in this section. Otherwise the information under Type 923 will apply to both carriages.

Form Stop Device

This carriage has no paper brake, and the end of form stop control is in the form of a switch located on the right side of the Type 407 Accounting Machine (Figure 88). The end of form stop located in the center of the paper feed stops the machine when the carriage runs out of paper, provided the form stop switch is turned on. The distance between the end of form stop and the printing line is about 13-3/8 inches.

Platen Shift Wheel

The platen may be shifted laterally a total of four inches by turning the platen shift wheel (Figure 88). However, to make this adjustment, the carriage shift lock must be raised to free the carriage. The carriage shift lock prevents the carriage from shifting laterally. When the carriage shift lock is raised to shift the carriage, the paper clamp bands tighten against the platen (on machines having clamp bands). This prevents possible damage to the paper clamp bands while the carriage is being shifted. This adjustment should not be made while the machine is in operation.

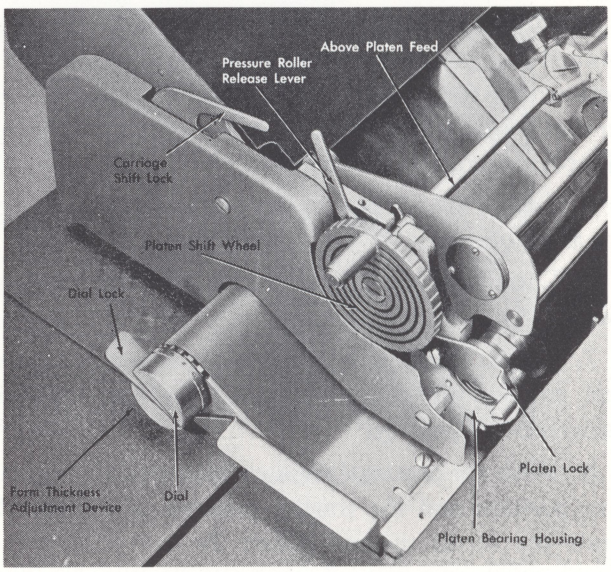


FIGURE 88. LEFT SIDE OF 922 CARRIAGE

OPERATING POINTERS

THE PLATEN CLUTCH should be in a disengaged position (turned to right) while the tape is being inserted in the carriage, and especially when the restore key is depressed.

The tape must be inserted in the carriage so that the printed captions can be read. After inserting the tape, excess slack should be removed. The tape should be just tight enough so that it will give slightly when the top and bottom portions of the loop are pressed together.

Be sure that the brushes are clamped in position after the tape is inserted. Failure to do so will cause continuous running of the tape when the restore key is depressed, or when the first skip occurs.

When the carriage is not in use, the brushes should be clamped tightly against the pin-feed drive wheel.

Be sure that the form thickness device is set properly for the forms that are feeding through the machine. If it is set at notch 6 and single-sheet forms are feeding, printing may not take place. This is because the platen is too far away from the typebars.

The pressure release lever should be pushed backward when form feeding is accomplished by pin wheels. It should be pulled forward when form feeding is accomplished by pressure rolls.

Tapes should never be folded at the ends because the tape tends to overlap at the creases when traveling around the pin-feed drive wheel.

Be sure that the forms are fed under the form stop controls and not over them.

Do not use the stop button on the carriage to stop the accounting machine. Although this button will stop both the accounting machine and the carriage, it is not intended to be used in place of the regular accounting machine stop key.

The platen cannot be turned backwards unless the platen clutch is in a disengaged position.

Make sure that the carriage is restored and the platen clutch is engaged before beginning an operation. Failure to restore causes improper spacing of the forms; failure to engage the platen causes all printing to take place on the same line.

HOW TO OPERATE THE TAPE-CONTROLLED CARRIAGE

1. Turn the platen clutch to a disengaged position.
2. Raise the cover of the carriage.
3. Raise brushes by a slight pressure on the latch.
4. Remove the tape by raising the lever on the notched bar and moving the lever slightly to the left. The tape will then slide off the half-circle guide pieces and the pin-feed drive wheel.
5. Insert the new tape as follows:
   a. Hold the tape so that the printed captions can be read.
   b. Loop one end over the pin-feed drive wheel so that the pins engage the center drive holes.
   c. Place the opposite end of the loop around the nearest half-circle guide piece.
   d. Remove excess slack by lifting the lever away from the notched bar and by moving the guide piece to the right. The tape should be just tight enough so that it will give slightly when pressed together.
6. Clamp the brushes in position.
7. Close the door.
8. Depress the restore key.
9. Push the pressure release lever backward.
10. Feed the forms from the back of the machine under the form stop controls and under the platen, until the end of the form can be grasped by the hand.
11. Adjust and align the form according to the type of form-feed device used. If no form-feed device is used, straighten and align the form around the platen.
12. Pull the pressure release lever forward if the pin wheels are not used; otherwise, leave it pushed back.
13. Depress the restore key once more.
14. Close the cover.
15. Turn the platen clutch to its engaged position.
16. Depress the start key to begin the operation.

REVIEW QUESTIONS

1. What is the purpose of the tape-controlled carriage?
2. How is single and double spacing controlled?
3. What is the purpose of the round holes in the center of the tape?
4. In what direction must the platen clutch be pointing before the platen can be moved manually?
5. How is the carriage set at the start or home position?
6. Which way should the tape face while it is being inserted in the carriage?
7. How are the brushes lifted away from the pin-feed drive wheel?
8. How tight should the tape be for most efficient operation?
9. Can a tape be used more than once?
10. What is the purpose of the form thickness adjustment device?
11. What happens when the last form passes the form stop controls?
12. In what position must the pressure release lever be so that the paper can be moved freely around the platen?
13. The platen can be shifted laterally four inches to the left or right. How is this done?
14. Can the platen be shifted while the machine is in operation?

FORM-FEEDING DEVICES FOR USE WITH THE TYPE 922 TAPE-CONTROLLED CARRIAGE

Two TYPES of form-feeding devices are available on the Type 407 Accounting Machine: the IBM Above-Platen-Feed Device and the IBM Forms Tractor. The Forms Tractor is standard on all machines shipped after January 30, 1953.

IBM Above-Platen-Feed Device (Model A-3)

The above-platen-feed device is designed especially for the Type 407 and may be freely inserted into the carriage. It is used for feeding marginally punched continuous forms with six-lines-per-inch spacing, and consists of two adjustable pin wheels with paper clamps attached. It fits into two slots on either end of the carriage and can be removed as easily as it can be inserted. It also swings back out of the way of the platen if desired.

The lower part of the feed device contains an 18-inch scale that is used in conjunction with the scale on the carriage, to assist in setting the pin wheels so that they line up with the paper guide and band assemblies. The blackened areas represent feed-roll positions and need not be considered when using the above-platen feed.

Paper Guide and Band Assembly

To keep the paper in position and firmly against the platen during all printing cycles, the left and right paper guides (Figure 89) are equipped with metal bands, which encircle the platen and can be attached to either the above-platen feed or the tear bar. The guide and band assembly may be positioned at the front and the rear along an upper and lower scale as will be explained under *Setting Paper Guides and Band Assemblies.*

The bands fit loosely around the platen when the machine is not in operation, thus allowing forms to be fed between the bands and the platen. On every print cycle, the bands tighten against the platen and hold the paper firmly.

When the metal bands are disconnected from the above-platen feed or the tear bar, they hang loosely over the print wheel cover on the machine.

Paper Guide and Band Assembly Scale

An 18-inch scale is permanently attached to the carriage just below the back cover. The black areas on the scale represent the location of the pressure rolls and the white areas represent the space between the pressure rolls. The scale is used when the paper guide and band assemblies are being set.

Tear Bar

The tear bar is used whenever feeding is under the control of the pressure rolls. It is a long, narrow metal instrument with a paper clamp on either end that may be set along an 18-inch scale to line up with the rear paper guide and band assembly. The scale is a permanent part of the tear bar. The blackened areas represent the location of the feed rolls and serve as a guide

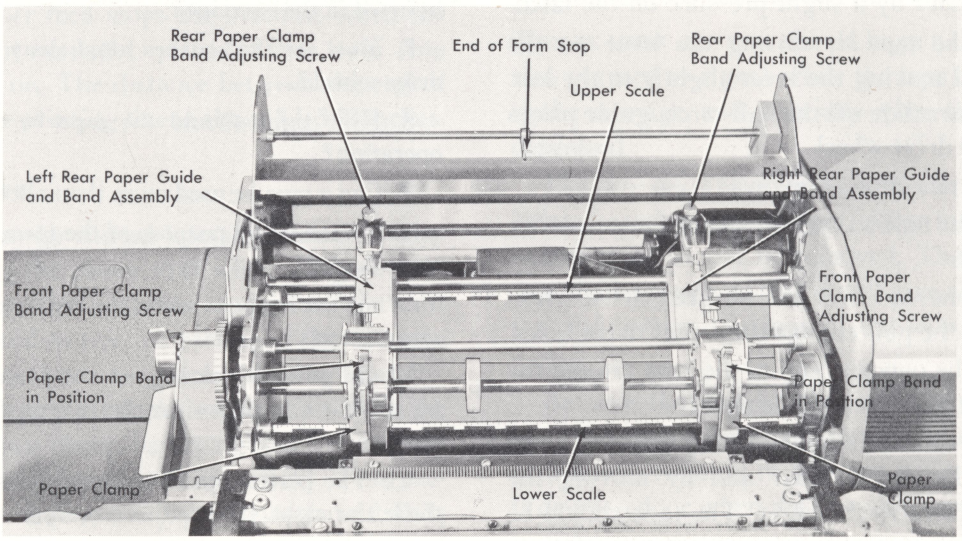


FIGURE 89

to prevent setting the bands on the feed rolls during pressure feeding operations.

The tear bar is generally used for single-sheet operations and when roll paper is being used. It is easily inserted in the carriage by placing the ends into the forward slots on the carriage frame.

Platen

The carriage is equipped with an easily removable solid platen as a standard feature. The platen may vary in hardness with the number of parts in each form. A medium platen (90 durometer) is recommended for 6-part forms and under. A hard platen (100 durometer) is recommended for 7-part forms and over.

The platen may be removed (Figure 90) by raising the platen lock on the left side and lifting the platen from the bearing housing. When the platen is inserted, the end with the gear wheel should be placed in the slot on the right of the carriage, and the left end should be dropped into the platen bearing housing. The platen must then be moved to the right, turning it back and forth, in order to fit the platen drive key into the carriage drive mechanism. The platen lock is then closed.

Figure 90 shows the paper clamp bands disassembled and the above-platen feed in a raised position.

Carriage Adjustment

Setting Paper Guides and Band Assemblies

The best method of setting the paper guides and band assemblies is illustrated in the schematic drawings that follow. Figure 91 (A and B) shows the steps necessary for setting the guides and band assemblies

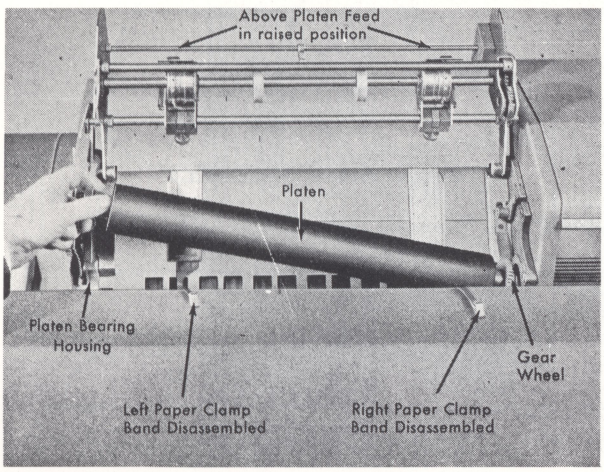


FIGURE 90. PLATEN

when the above-platen feed is used, and Figure 91C when the tear bar is used. These instructions may be followed only for forms with 1/4 inch margins (distance from center of feed hole to edge of form), which will include the majority of forms.

The black marks on the upper and lower scale represent the location of the pressure rolls and need only be considered when pressure feeding (as described under *Tear Bar*).

Steps in Using Above-Platen Feed
(Figure 91, A and B)

1. Measure the over-all width of form (10-1/2″ in example).
2. Raise rear cover.
3. Remove left band from stud.
4. Determine the first print wheel being used and set left rear paper guide and band assembly slightly to the left of it, preferably so that the rear form position locator rests on an even 1/4″, 1/2″, or 1″ mark along the scale. (The example shows the form position locator on the 1-inch mark.)
5. Raise the paper clamp that rests on the left pin wheel.
6. Secure the left pin wheel assembly so that the lower form position locator rests at the same position on the lower scale as the rear form locator does on the upper scale. (Left pin wheel set at 1″ in the example.)
7. Remove right band from stud.
8. Set right rear paper guide and band assembly so that the right rear form position locator rests on a scale reading, determined by adding the over-all width of the form to the left guide reading (10-1/2″ + 1″ = 11-1/2″ in example).
9. Raise the paper clamp that rests on the right pin wheel.
10. Secure right pin wheel assembly so that right lower form position indicator rests at the same position on the lower scale as the rear form indicator does on the upper scale. (Right pin wheel set at 11-1/2″ in the example.)
11. Close rear cover.
12. Insert form and close both right and left paper clamps.
13. Replace right and left bands on studs, making sure that the bands are under the paper clamps.
14. Set form so that first printing line is even with the first printing line indicator mark on paper clamp. Then, turn the paper back 11 spaces to place the form in printing position.

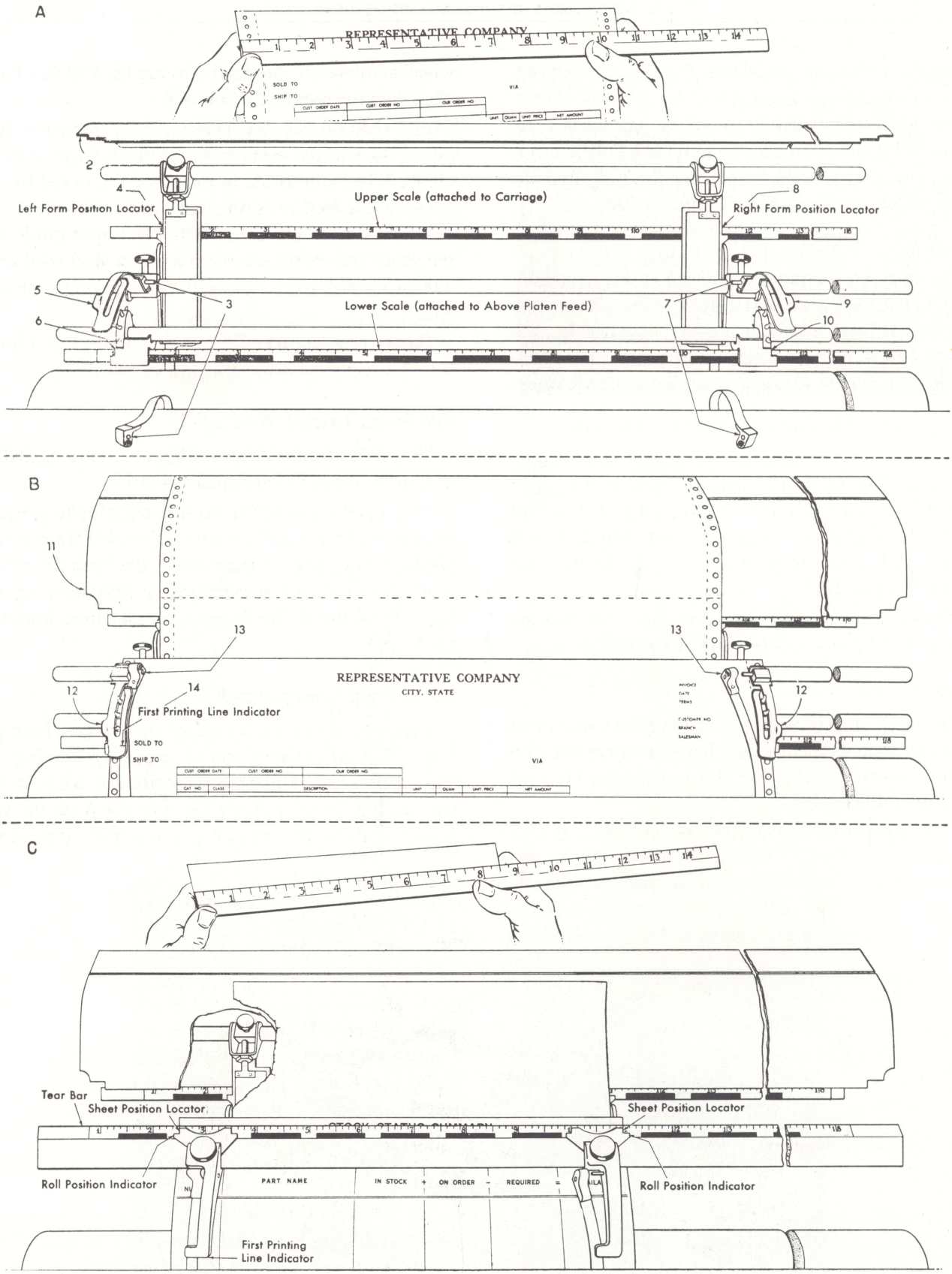

A
REPRESENTATIVE COMPANY
SOLD TO
SHIP TO
VIA
Left Form Position Locator
Upper Scale (attached to Carriage)
Right Form Position Locator
Lower Scale (attached to Above Platen Feed)
B
REPRESENTATIVE COMPANY
CITY, STATE
First Printing Line Indicator
SOLD TO
SHIP TO
VIA
C
Tear Bar
Sheet Position Locator
Sheet Position Locator
Roll Position Indicator
Roll Position Indicator
PART NAME
IN STOCK + ON ORDER − REQUIRED =
First Printing
Line Indicator

FIGURE 91

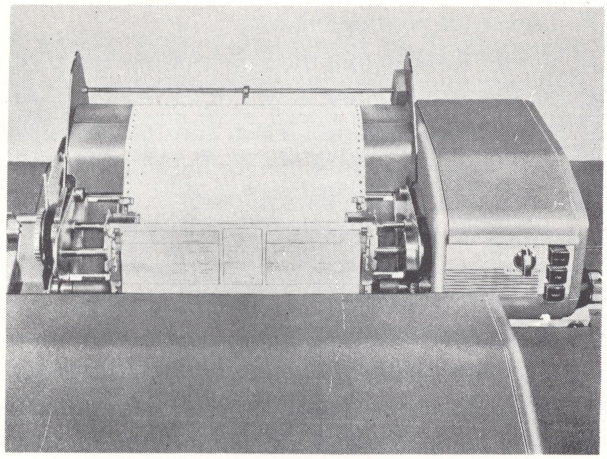


FIGURE 92. CARRIAGE READY TO OPERATE

Adjust the carriage laterally so that the print wheels line up exactly with the printing positions on the form. The easiest way to accomplish this is to have a symbol preprinted on the form to identify print wheel, 1, 60, or 120.

Figure 92 illustrates a form inserted in the carriage with an IBM Above-Platen Feed Device.

Steps in Using the Tear Bar (Figure 91C)

The steps necessary for positioning the paper guide band assemblies when the tear bar is used are the same as those necessary when the above-platen feed is used, with the following exceptions:

1. The paper clamps on the tear bar replace the pin wheel assemblies. They move along the tear bar laterally when the pressure is released.

2. When the tear bar is used, form feeding is done by pressure of the feed rolls against the paper and the platen. The band would be damaged if allowed to ride between the feed rolls and the platen. Therefore, the roll position indicators on both the paper guide and the paper clamps must never rest on a blackened area. The blackened areas represent the location of the feed rolls.

Bands being replaced must slide under the clamps before being attached to the studs.

IBM Forms Tractor (Model F-2)

The IBM Forms Tractor, Figure 93, is supplied on machines shipped after January 1, 1953.

This device is used for feeding marginally punched continuous forms and has two adjustable tractor-type pin-feed units, one for each side of the form. It may be freely inserted in the carriage by first hooking the rear pin of the device in position and then lowering the front.

Six or Eight Lines per Inch

Spacing may be set for either six or eight lines per inch. This adjustment can be made by moving the shift cam until its pointer is positioned between the two scribed lines by either the *6* or the *8* on the side frame. If the pointer cannot be positioned between the

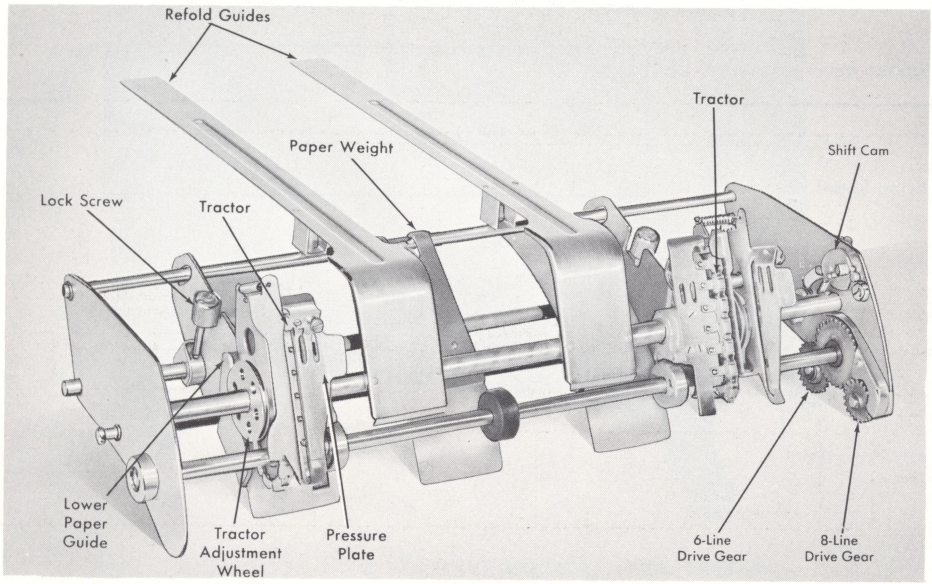


FIGURE 93. FORMS TRACTOR

scribed lines, a tooth-on-tooth condition exists between the platen gear and the forms tractor drive gear. In this case, move the shift cam to release the pressure on the 6- or 8-line drive gear and turn the platen slightly to allow the teeth to engage fully. Single spacing at 8 lines per inch is not recommended where the accuracy of line spacing is critical.

Steps in Using the Forms Tractor

1. After the forms tractor is in position, make sure that the platen and the forms tractor can be moved freely by hand.

2. If a narrow form is to be used, remove the center paper guide that supports the form in the center.

3. Move the left lower paper guide and tractor slightly to the left of the first printing position. Place the first form between the left and right lower paper guides and move the right guide in against the edge of the form. Allow a slight clearance so that the form slides freely between both guides. Tighten both lock screws to hold the guide assemblies in place.

4. With the pressure rolls engaged, insert the form under the carriage between the round rod and the platen, and then into the pressure rolls. Turn the platen by hand (platen clutch disengaged) until the end of the form can be grasped.

5. Raise the pressure plates away from the pins.

6. Release the pressure rolls, draw up the form, and attach the pin-feed holes to the tractor pins.

7. Lower the pressure plates.

8. Set the form so that the first printing line is even with the first printing line indicator mark on the lower part of the pressure plates. Then, turn the form back 14 spaces if spacing is set for six lines per inch, and 19 spaces if set for eight lines per inch.

Tractor Adjustments

Tractor Adjustment Wheels

The tractor adjustment wheels may be turned to provide a 1/8" lateral movement of the tractors. The wheels are used to make the chain pins line up exactly with the center of the marginal holes in the paper after the paper guides have been set.

RIBBON REPLACEMENT

THE RIBBON feeds from one spool to the other about one inch on each print cycle. It feeds in one direction until a metal eyelet near the end of the ribbon on either spool strikes the ribbon-reversing-lever, thus reversing the feed.

When a new ribbon is installed, it is important that the leading end of the ribbon is firmly hooked onto the empty spool. Enough ribbon should be wound around the empty spool so that the metal eyelet is somewhere between the spool and the reversing lever. The threading of the ribbon around the guide rollers is shown in Figure 94.

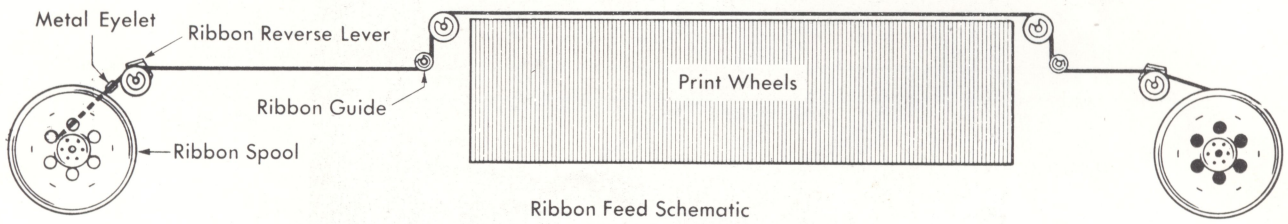


FIGURE 94. SCHEMATIC OF RIBBON FEED

IBM INTERPRETERS

DURING THE early stages of development of punched card accounting, the cards were used only as "tools" or media from which reports were prepared. There was little or no reference to individual cards after reports were completed, and visual reading of the holes was seldom necessary.

Today, however, IBM cards are used not only for the automatic production of reports but also as documents. For example, original source documents such as address cards, payroll cards, time tickets, inventory tags, checks, income tax returns, and car registrations are often designed as IBM cards. To assist in the visual reading of punched data, it is desirable that the punched information be translated into printed form on the card itself. Thus, the information punched in the cards can be read with the same ease as typewritten records.

One of the machines that have made this use of cards possible, by translating punched data into printed form, is the Type 552 Alphabetical Interpreter.

TYPE 552

THE ALPHABETICAL INTERPRETER (Figure 95) is equipped with a card feed hopper located on the upper right end. Cards to be interpreted are placed in the feed hopper, face up, with the top edge (12's) entering

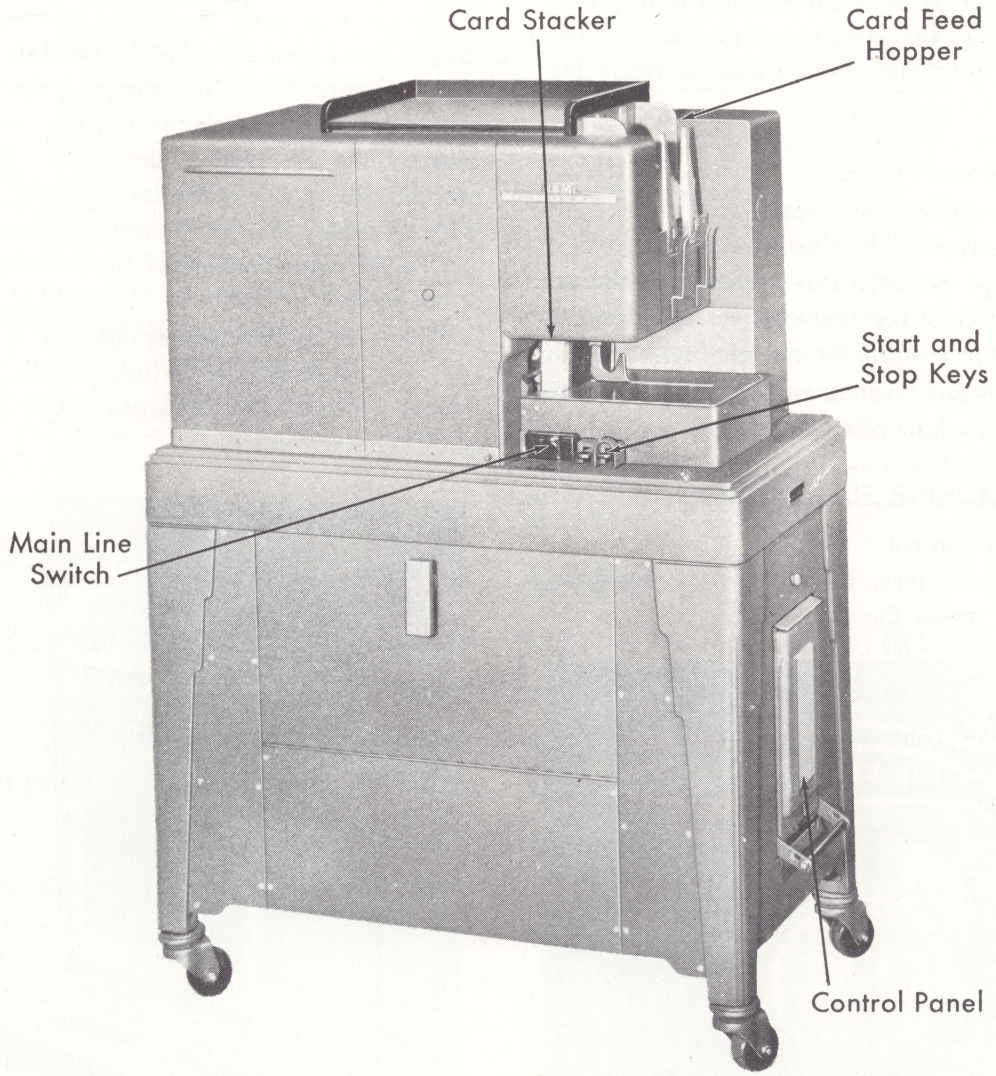


FIGURE 95. TYPE 552 ALPHABETICAL INTERPRETER

the machine first. The approximate capacity of the feed hopper is 700 cards.

Cards feed through the machine at a speed of 60 cards per minute. When the feed hopper becomes empty, the machine stops automatically as the last card reaches the stacker.

The stacker, located directly below the hopper, has a capacity of about 900 cards. The cards stack vertically with the 12's at the bottom. The machine automatically stops when the stacker becomes full.

OPERATING FEATURES

Main-Line Switch

The main-line switch, located just below and in front of the stacker, must be turned on to supply current to the machine. When the main-line switch is on, a red light indicates that the machine is ready for operation.

Start and Stop Keys

The start and stop keys are located just to the right of the main-line switch. The start key is covered, and must be depressed to start cards feeding into the interpreter. The machine continues to operate as long as cards are feeding, or until the stacker becomes full.

The stop key is not covered, and is used to stop the operation of the machine when necessary.

MACHINE FUNCTIONS

Printing Position Control

Interpreted characters, numerical or alphabetic, may be printed across the top of the card on a line above the 12 positions of the card, or between the 12 and 11 positions, according to the setting of the printing position knob (Figure 96).

The printing position knob is located at the back of the machine, behind the feed hopper. When the knob is pulled out and turned to the right (clockwise), it is set to print on the upper line above the 12 punching position (Figure 97). When pulled out and turned to the left (counterclockwise), printing will appear on the lower line, between the 12 and 11 punching positions (Figure 98). A position indicator shows the line on which the knob is set. In Figure 96, the knob is set for printing on the lower line.

Printing Capacity

The printing of the characters across the top of the card is controlled through the medium of a control panel (Figure 99). When the properly wired control panel is inserted and clamped in the receptacle at the right of the machine, it electrically "instructs" the machine what fields of the card to read and where the printing must take place. Cards are usually designed so that the exact location of the printing is indicated on the form.

The printing mechanism consists of 60 typebars, each bar containing 38 printing characters—10 numerical (0 to 9); 26 alphabetic (A to Z); and three special characters.

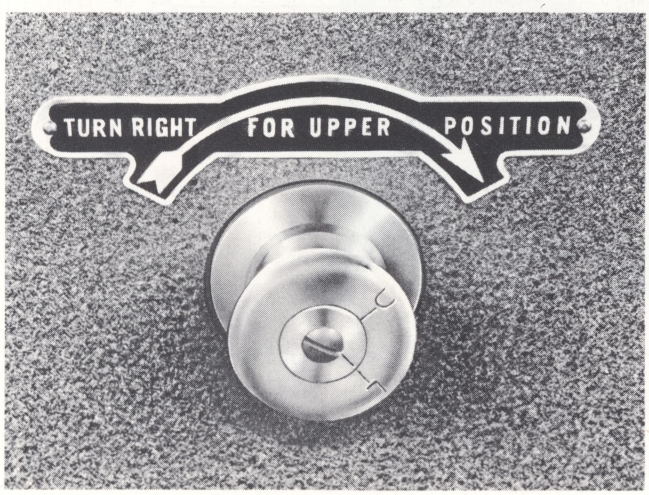


FIGURE 96. PRINTING POSITION KNOB

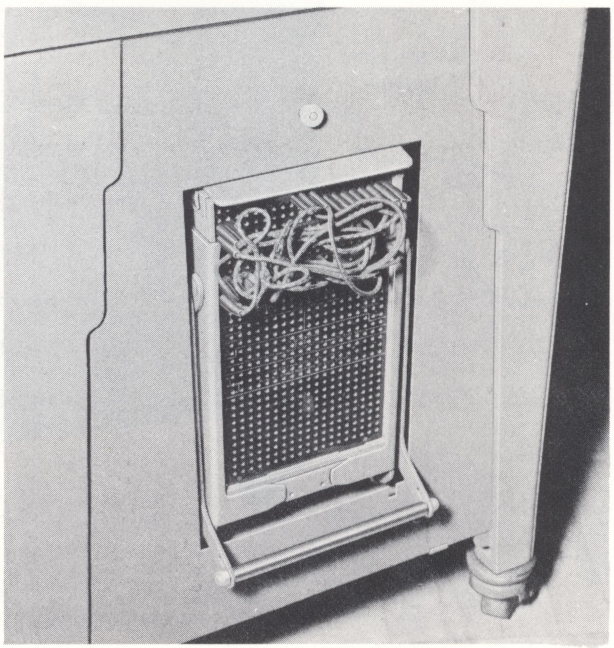


FIGURE 99. CONTROL PANEL

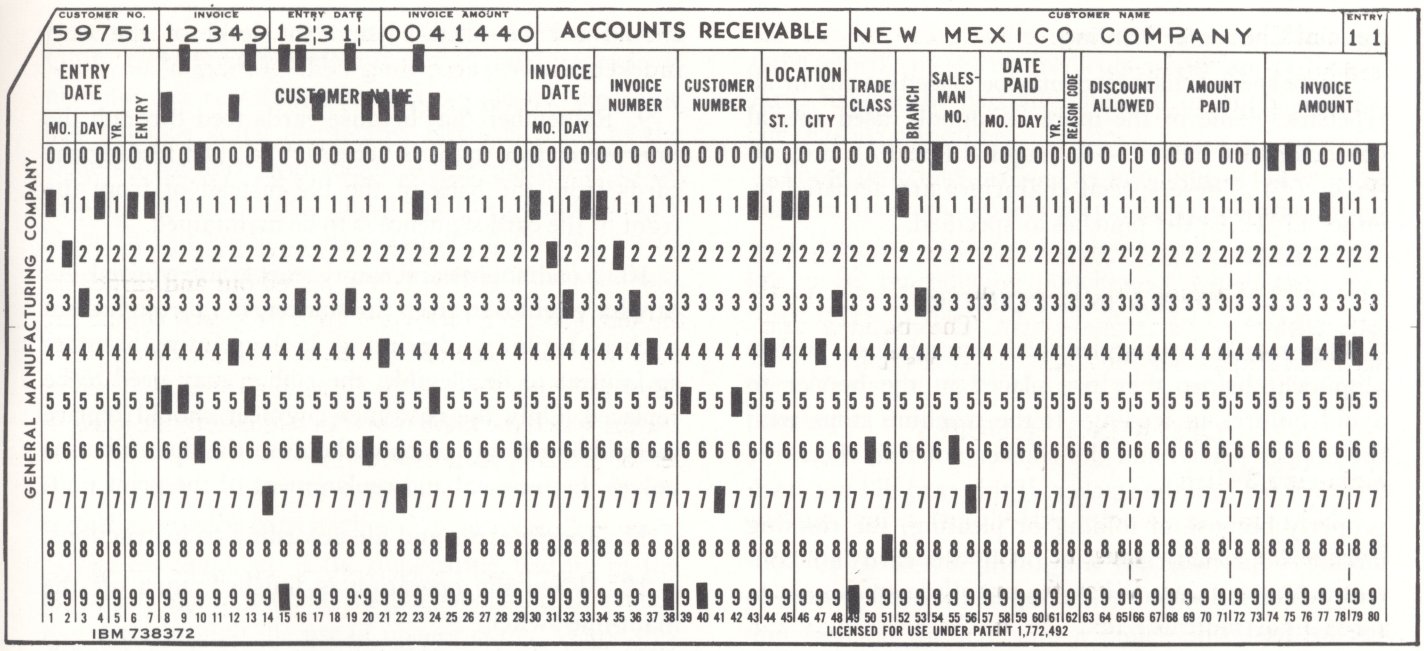


FIGURE 97. CARD INTERPRETED ON UPPER LINE

If 60 columns of interpreting are sufficient, and all printing is to occur on one line, the operation may be accomplished in one run of the cards through the machine. If it is necessary to interpret more than 60 columns, the cards must be run through the machine a second time, using the other printing line for the additional interpreting. It is necessary to use a second control panel, or to rewire the first, to interpret on the second line.

Zero Printing

The Alphabetical Interpreter prints zeros only if the zero positions are punched in the cards and the card columns are wired to typebars. For example, 25 punched in a four-column field will interpret as 0025. Unpunched card columns are not interpreted, and blank columns occurring in alphabetically punched fields appear as spaces between words.

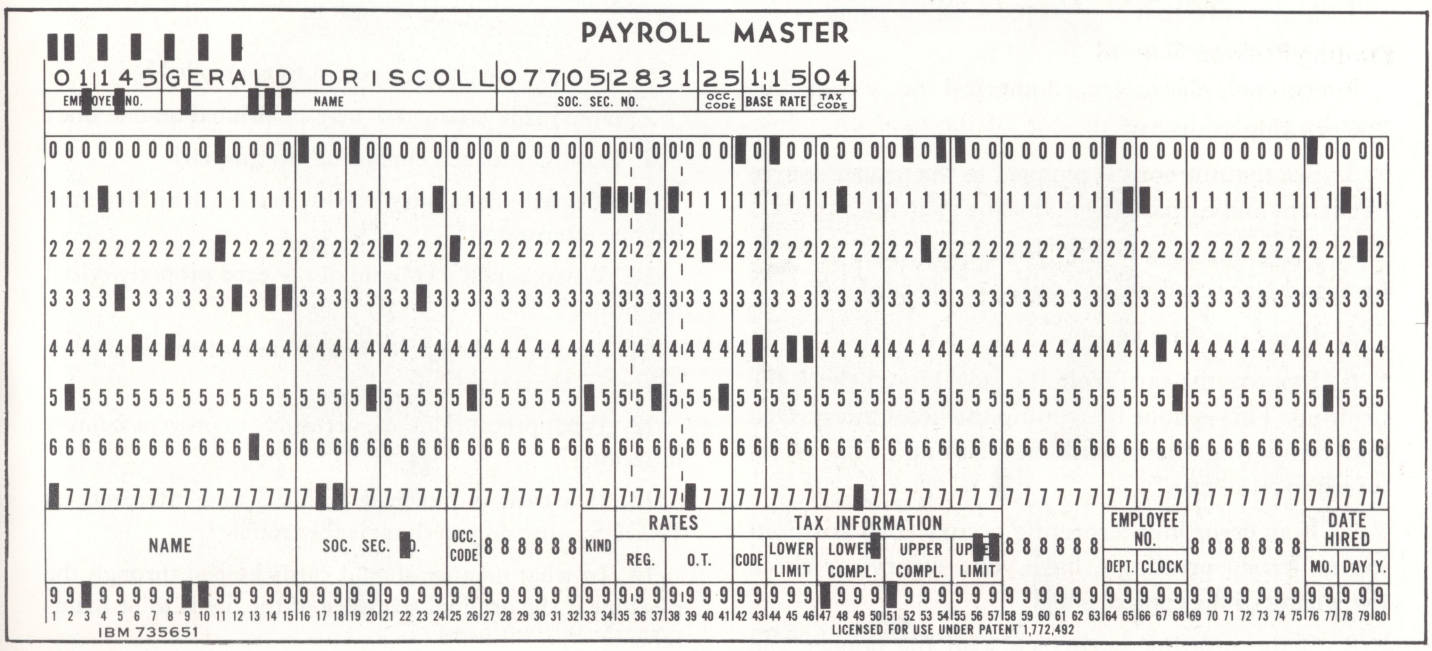


FIGURE 98. CARD INTERPRETED ON LOWER LINE

Special Character Printing

Three special characters may be placed on any or all typebars. Some of the more commonly used special characters are dash (—), diagonal line (/), and asterisk (*). These special characters are actuated by either 11, 12, or 0-1 punches as specified.

OPERATING POINTERS

CARDS should be joggled and arranged in perfect alignment before they are placed in the hopper to avoid failures in feeding. If the machine stops with the hopper loaded and the stacker not full, check the last card fed into the stacker. If this card did not stack properly because of folding or pleating, the running circuit is automatically shut off by the card jam control, which is located at the top of the stacker next to the last feed roll.

Remove folded or pleated cards and check to determine whether they should be repunched in order to avoid feeding trouble in future machine operations. It must be remembered that all repunched cards must be thoroughly checked. They must be exactly the same as the original cards. Damaged cards should be torn and placed in the proper receptacle, as directed by the supervisor.

HOW TO OPERATE AN INTERPRETER

1. Make sure that the proper control panel is inserted and clamped in the machine.

2. Set printing position knob for upper or lower line printing as desired.

3. See that the cord is plugged to the proper source of current and turn on the main-line switch.

4. Place one card in the feed hopper, face up, 12's first, and place card weight on top of the card.

5. Press the start key.

6. Remove the card from the stacker and check the printing. This is done by reading the holes interpreted and comparing them with the printing. This is referred to as a "test."

7. If an error in interpreting occurs (bad positioning or wrong printing), have your supervisor check the wiring of the control panel.

8. If the printing is correct, load the hopper and place the card weight on top of the cards. The hopper should not be filled beyond the level of the card brackets.

9. Remember that because cards feed through the interpreter face up, it is necessary to start feeding the cards from the back of the file instead of from the front, if the card sequence is to be maintained.

10. Load hopper and empty stacker as required. As cards are removed from the stacker, fan through them to check legibility of printing. If the printing becomes so faint as to be illegible, the ribbon may need to be replaced. Only the customer engineer should replace the ribbon on this machine because the operation involves the removal and replacement of the print unit.

11. Joggle cards and file according to instructions.

12. When the operation is finished, turn off the main-line switch.

13. Remove the control panel and store in the proper place.

REVIEW QUESTIONS

1. What is the purpose of the alphabetical interpreter?
2. How are cards placed in the hopper?
3. How do they stack?
4. What may stop cards from feeding from the hopper?
5. Where will interpreted information appear on the card?
6. How are the printing positions controlled?
7. How many characters may be printed on one line?
8. How may all 80 columns be interpreted?
9. How will the number 50046 punched in an 8-column field be interpreted?
10. When would a column of the card properly wired not print?
11. What punched holes in a column of the card print as special characters?
12. What precautions are necessary to prevent failures in feeding?
13. If a card is punched JONES and interprets as JNOES, what do you think is the trouble?
14. In what manner should cards be run through the machine if the original sequence of the file is to be maintained?
15. What is the speed of the alphabetical interpreter?

IBM REPRODUCING PUNCHES

ONE CHARACTERISTIC of manual records is monotonous repetition. Records made on the same day must be dated identically. Records made at the same source must bear identical information as to location. Likewise, information used at one point may be needed at another, often requiring duplication of the same basic records. In some cases, partial changes to the original records have to be made continually in order to keep the record up-to-date.

For many years, the only method of punching holes in IBM cards was through key depression of a manually operated keypunch. Information had to be read by the eye, either from an original document, or from recordings on the card itself.

The development of the duplicating feature of the keypunch eliminated the manual punching of repetitive data through the use of master cards. While this feature is useful as an aid in keypunching, it does not satisfactorily meet requirements where entire files of cards have to be partially changed or duplicated for one reason or another.

These functions, as well as punching total or summary cards from reports prepared by the accounting machines, are performed automatically by machines known as reproducing punches, of which there are three types: Types 513, 514, and 519. The Type 519 differs from the other two in that it can print across the left or right end of the card as many as eight digits punched in the card.

TYPE 513

As MAY be seen from Figure 100, the Type 513 Reproducing Punch has two card feed hoppers: a read-unit feed on the left, and a punch-unit feed on the right. Each feed has a capacity of about 800 cards.

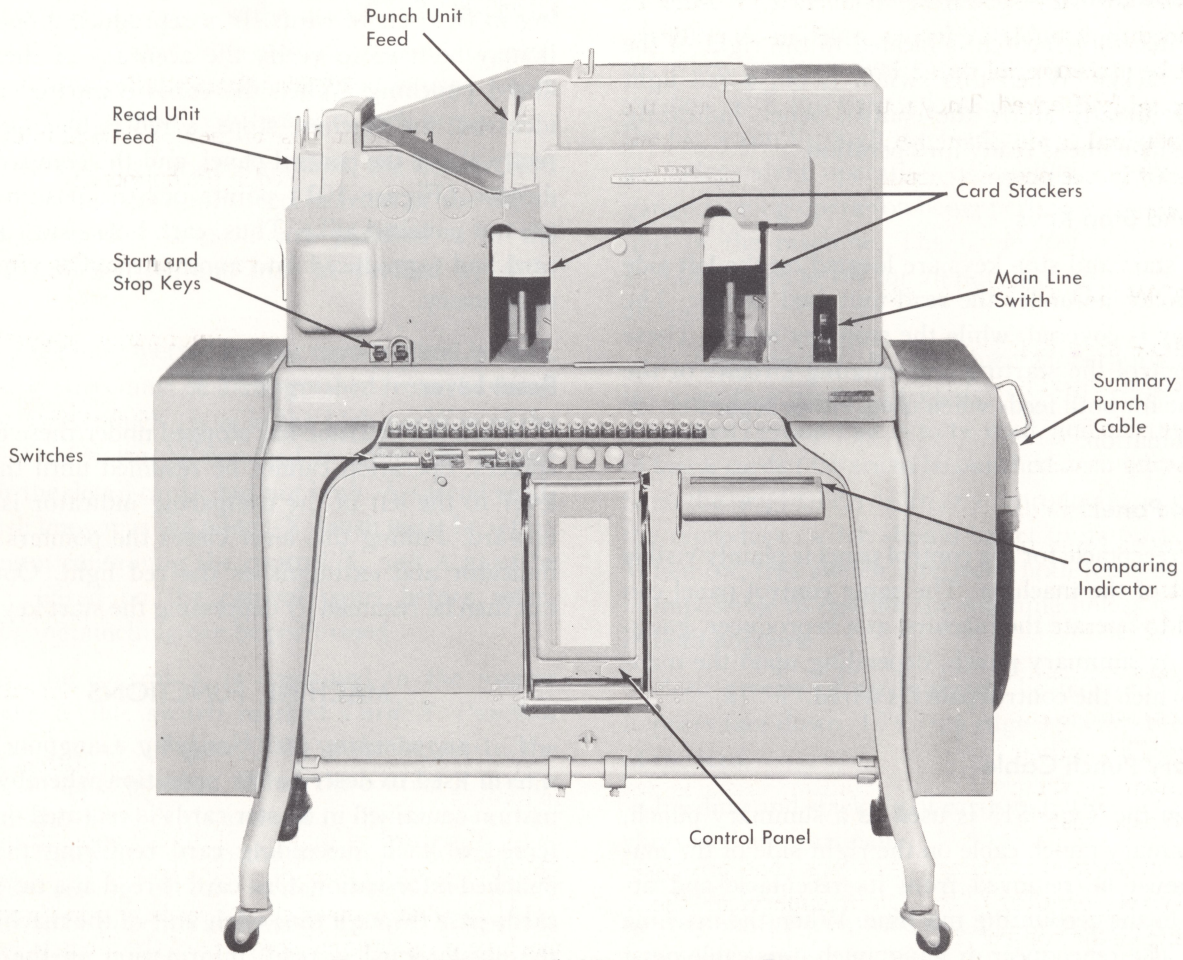


FIGURE 100. TYPE 513 REPRODUCING PUNCH

The names of the two units are self-explanatory because, in a reproducing operation, one unit of the machine reads previously punched cards, while the other unit punches blank cards that are to become duplicates of the original. *Cards must feed through either hopper face down, 12's or top edge toward the throats of the feeds.*

Because the card files (original and duplicate) are to remain separate, the machine also has two stackers which receive the processed cards, one for the cards passed through the read unit and one for the cards passed through the punch unit. Each stacker has a capacity of about 1,000 cards; if either stacker is filled to capacity or either hopper becomes empty, the machine will automatically stop. The machine operates at a speed of 100 cards per minute.

OPERATING FEATURES

Main-Line Switch

The main-line switch is located to the right of the punch stacker. When this switch is on, a red light appears directly above the control panel, indicating that the machine is ready for operation.

Start and Stop Keys

The start and stop keys are located on the left side of the machine under the read-unit feed hopper. The start key is covered, while the stop key is not. These keys control the starting and running circuits of the machine for both feeds when used, either separately or in combination.

Control Panel

The receptacle for the control panel is plainly visible in front of the machine. The same control panel can be used to operate the machine as a reproducer, gangpunch, or summary punch, depending upon the manner in which the control panel is wired.

Summary Punch Cable

When the Type 513 is used as a summary punch, the summary punch cable on the right side of the machine must be removed from its receptacle and attached to the accounting machine. When the machine is used as a reproducer or gangpunch, this cable must be kept in the receptacle and latched; otherwise, the machine will not operate.

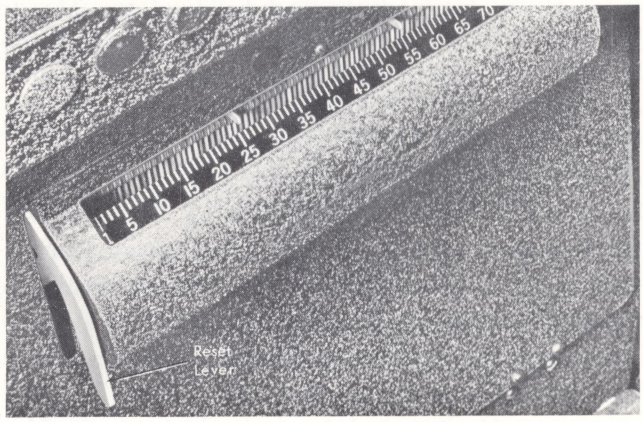


FIGURE 101. COMPARING INDICATOR

Comparing Indicator

The comparing device is an important feature of the machine and may be used to compare the punching in two sets of cards. In a reproducing operation, it may be used to verify the accuracy of the reproduced punching. When the cards compared are not identical, the machine stops, a red light appears directly above the control panel, and the comparing indicator (Figure 101) points out the positions that are not punched alike. Thus, each hole read from one card and reproduced into another may be verified as to accuracy.

Reset Lever

When the machine has stopped under these circumstances, operation cannot be resumed until the reset lever to the left of the comparing indicator is pulled upward. Pulling this lever clears the pointers on the indicator and extinguishes the red light. Operation can then be resumed by depressing the start key.

MACHINE FUNCTIONS

1. *Gangpunching and Verifying.* Gangpunching is a term used to describe the operation whereby information contained in master cards is repeated or transferred to each succeeding card requiring the same punched information. One card is read at a time as the cards pass through the punch unit of the machine. As the master card is read, information on the master card is automatically punched into the following card. Cards feed continuously; and as the first detail card

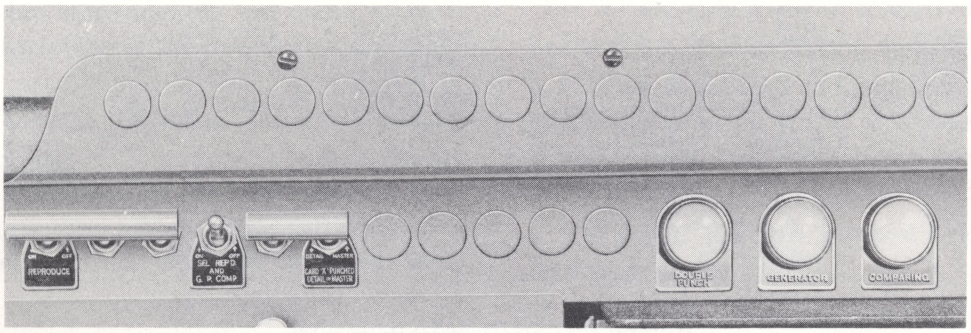


FIGURE 102. SWITCHES

(originally blank but now punched) is read by the machine, the information is transferred to the next blank card, and so on, until the operation is completed.

There are two methods of gangpunch operations. One method requires the use of only one master card and is used where the same information is to be punched in every card passing through the machine. The other method requires the use of more than one master card properly interspersed in front of each group of cards to be gangpunched and is used where the common information differs as to each group.

In the single master card method, the master card is placed in the punch unit feed in front of the file to be gangpunched. All cards are punched with the identical information, and may be verified by sight checking.

When the interspersed master card method is used, the master cards must be distinguished from the detail cards by an X-punch (hole in the 11th position of the cards). This X can be punched in either the master cards or the detail cards, but not both. A special reading brush known as the punch-X brush must be set on the column containing the control X, and it must be properly wired on the control panel before interspersed gangpunching can be performed.

When the control X is contained in the master cards, the double switch marked *Card X Punched Detail or Master* (Figure 102) must be set to the MASTER or upper position. When the control X is contained in the detail cards and not in the master cards, this switch must be set to the DETAIL or down position. The setting of this switch determines which cards are to be punched and which are not. When it is set on MASTER, punching will be suspended for cards containing the control X, but cards without the X will be punched. When it is set on DETAIL, cards containing the X will be punched and punching will be suspended for cards without the X.

In either of these gangpunching operations, the switch marked *Reproduce* ON-OFF (Figure 102) must be set to the OFF position.

The single switch, between the two double switches, marked *Selected Reproducing and G. P. Comparing* (Figure 102) has a special purpose. It should be set ON when gangpunched cards are to be compared or verified with interspersed master cards. To do this, the file is run through the read unit of the machine as an independent operation or simultaneously with a gangpunching operation being performed in the punch unit of the machine. The G. P. comparing switch should always be off for all normal reproducing operations.

2. *Reproducing.* A reproducing operation always involves two groups of cards; i.e., (1) the original (punched) group that is to be read, and (2) the group of blank cards that are to be punched with information from the original cards. In any reproducing operation, the reproduce switch should be set to its ON position. When ON, this switch interlocks both feeds so that it is impossible to operate the machine unless cards are in both hoppers.

Both groups of cards should be fed into the feed hoppers face down, 12's (top edge)toward the throat of the feed.

Feeding and stacking of cards in both units are synchronized automatically.

The design of the card forms of both groups may or may not be identical, and the information may be reproduced from the original cards into the same or entirely different columns of the blank cards, as desired. Variations in card design, or columns to be

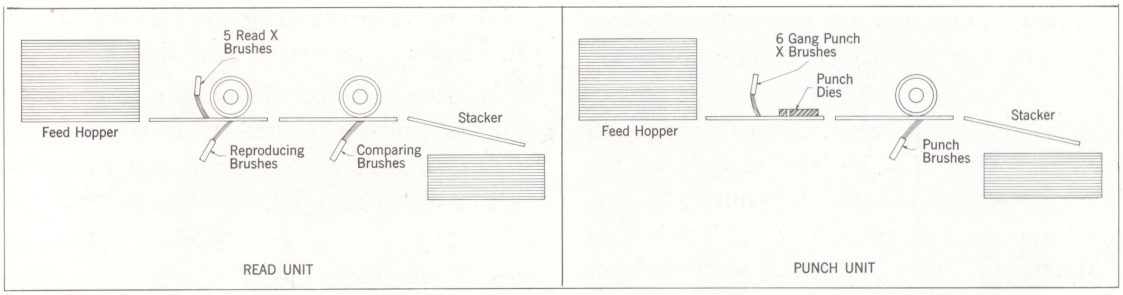


FIGURE 103. SCHEMATIC DIAGRAM

punched, must be considered in setting up or wiring the control panel for the operation.

The use of the comparing unit in the machine, to verify the punched data as they are reproduced, is desirable in any reproducing operation.

3. *Combination Reproducing and Gangpunching.* This operation combines both reproducing and gangpunching functions in one run of the cards through the machine, and is a simple operation where only one master card is to be used. *The original set of cards should be preceded by a blank card in the read unit feed hopper, in order to prevent reproducing into the master card.* The master card should be placed in front of the blank cards in the punch-unit feed hopper. From an operating standpoint, this operation is the same as reproducing without gangpunching, and the Reproduce switch must be set to its ON position.

The comparing unit can be utilized to verify the reproduced portion of the duplicate cards, but the gangpunched columns of the duplicate cards should be sight-checked each time the punch stacker is emptied. A schematic diagram of both feed units is shown in Figure 103.

4. *Summary Punching.* Summary punching is the automatic punching of totals accumulated or summarized by an accounting machine.

For example, when an inventory report is being prepared on an accounting machine, it can be set up to show, by each type of product, the balance on hand at the first of the month, the receipts and issues during the month, and the balance on hand at the end of the month. As totals are printed by each type of product, the information can be automatically punched into summary cards, by means of the summary punching circuits in the reproducing punch. These summary cards may then be used the following month for the preparation of the report.

When summary punching is to be performed, the summary punch cable on the right side of the machine must be connected to the accounting machine. The cable will transmit the summary information to be punched in each summary card. The blank summary cards must be placed, face down, top edge toward the throat of the punch unit feed hopper. Before the accounting machine can be started, at least two blank cards must be fed through the summary punch by depressing the start key. The reproduce switch must be off.

It is possible to gangpunch common information that must appear on all summary cards, simultaneously with punching summary information.

OPERATING POINTERS

DO NOT overload hoppers nor allow stackers to become too full.

Joggle cards into perfect alignment before placing them in feed hopper, face down, 12's toward the throat of the feed.

The plate cover over the rolls in the read feed should always be in its proper place.

In a reproducing operation, fill both hoppers approximately to the same level, and replenish both at the same time when necessary.

In emptying the stackers, stop the machine and remove cards from both stackers at the same time, before resuming the operation. Always match the last card removed from one stacker with the last card removed from the other stacker before placing the cards in the files.

If the machine stops and a red light appears, call your supervisor.

If the cards appear to be off-punched, check the registrations on a standard card gage.

If the machine stops and no red light appears, check the hoppers. One of them is empty and needs reloading.

When a reproducing operation is finished, unload the punch feed hopper if cards still remain in the punch-unit feed. Depress the start key until all cards have dropped into the stackers. Three card cycles are sufficient. Match and sight-check the last cards from both stackers.

In a gangpunching operation where only one master card is used, the cards should be sight-checked as removed from the punch stacker. Double check the last card removed to make sure that it is exactly like the master card. If not, the machine should be stopped as the entire group may need checking.

In a gangpunching operation where interspersed master cards are used, make certain that the card X-punched detail or master switch is properly set. Also, have your supervisor check the setting of the punch-X brush.

It is impractical to sight-check small groups of cards in interspersed gangpunching operations, but they can be electrically verified if the cards are run through the read-unit feed hopper. This requires a special setup on the control panel and also requires that the special switch marked G. P. comparing be set to its ON position.

When the cable is being attached to the accounting machine, the main-line switches on both the accounting machine and the summary punch must be off.

The cover of the cable receptacle on the accounting machine should be temporarily stored in the cable receptacle of the summary punch.

If a card jam occurs in the punch feed, ask your supervisor to help you. The operation must be carefully performed and can be learned only by personal instruction, repeated practice, and experience.

HOW TO OPERATE THE REPRODUCING PUNCH

1. Determine the type of operation to be performed; i.e., reproducing, gangpunching, combination reproducing and gangpunching, or summary punching.

2. Obtain a sufficient supply of the proper card forms to be used.

3. Arrange the cards to be used to avoid confusion in handling the files during and after the operation.

4. Plug in the cord to a source of current and turn on the main-line switch. If the operation is summary punching, attach the cable to the accounting machine before turning on the main-line switch.

5. Depress the start key and hold it down for at least three card cycles.

6. Check the stackers to see that there are no cards in the stackers. If any cards are found in the stackers, turn them over to the supervisor.

7. Insert the proper control panel.

8. Set the switches according to the operation to be performed:

Summary Punching: All switches OFF (up).

Reproducing: Reproduce switch ON (down), all others OFF (up).

Gang Punching: Reproduce switch OFF (up); X-master X-detail switch up or down, depending on the X punch. Punch X brushes should be set by the supervisor.

9. Place cards in the hoppers face down, 12's toward the throats.

10. In a reproducing operation, place the originals in the read-unit feed hopper and the duplicates in the punch-unit feed hopper.

11. Depress the start key.

12. Stop the machine after 4 or 5 card cycles and check the cards punched to see that all required columns are being properly reproduced, gangpunched, or summary punched (depending upon the operation, or operations performed).

13. In a summary punching operation, feed at least two cards through the machine before starting the accounting machine. The last card to feed through the summary punch will stop the accounting machine. If the operation is not completed, reload the hopper.

14. When the operation is finished, depress the start key until all cards remaining in the machine have been fed into the stackers. Turn off the main-line switch.

15. File the cards according to the instructions of the supervisor.

TYPE 514

THE TYPE 514 REPRODUCING PUNCH (Figure 104) is similar in function and operation to the Type 513. The Type 514 is more streamlined and several features have been relocated for more efficient operation.

The main differences between the two are as follows:

On the Type 513, the summary punch cable is located on the right side of the machine; on the Type 514, it is located on the lower left side of the machine behind a protective cover.

On the Type 513, the control panel is located in the center of the machine and all operating switches are on the outside above the control panel. On the Type 514, the control panel and all operating switches are located on the lower left side of the machine behind a protective cover (Figure 105).

On the Type 513, the start key (covered) and the stop key (uncovered) are located on the left side of

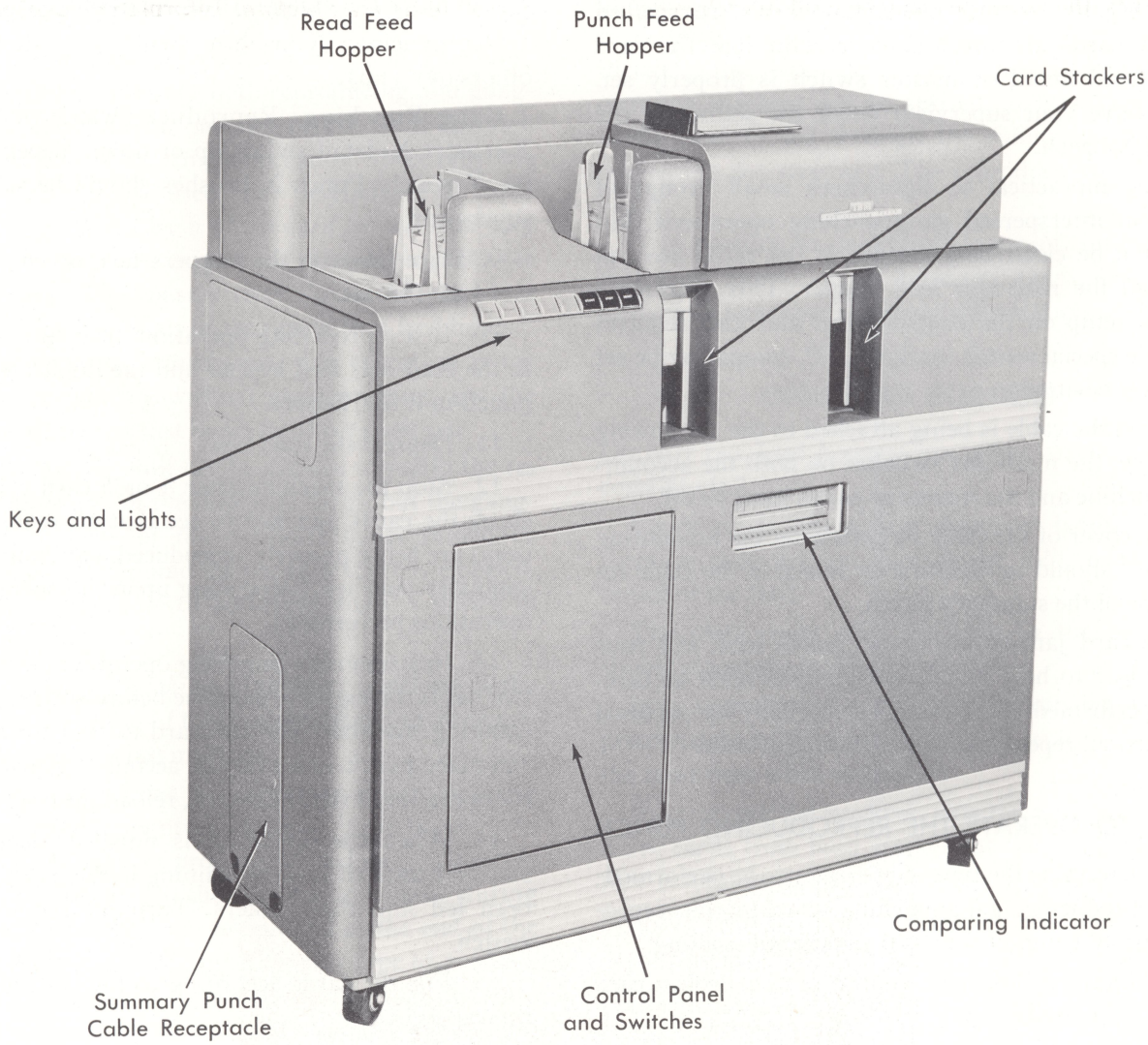


FIGURE 104. TYPE 514 REPRODUCING PUNCH

the machine near the read-unit feed hopper. The three signal lights: namely, double punch (a special feature), generator, and comparing are located directly above the control panel. On the Type 514, both the signal lights and operating keys are located in a row between the two card feed hoppers (Figure 105). A third key on the 514 is labelled *reset*. It is used to extinguish the DPBC (double punch and blank column) signal light that is a special feature.

On the Type 513, to clear the comparing indicator when the machine stops and the comparing light goes on, the reset lever is pulled; on the Type 514, the reset lever is pushed.

Only the Type 514 may be attached to the Type 407 for use as a summary punch. On all other accounting machines, the two types may be used interchangeably.

TYPE 519

THE TYPE 519 DOCUMENT-ORIGINATING MACHINE (Figure 106) is a reproducing punch and is identical in function and operation to the Type 514, with the exception that it has a printing unit for printing on the left or right end of the card as many as eight digits of information read from cards passing through the read unit or the punch unit. When the information is read from cards passing through the read unit and printed on cards passing through the punch unit, the operation is referred to as *transcribing*. When the information is read from cards passing through the punch unit and printed on the card from which the information is read, the operation is referred to as *interpreting*. Information interpreted or

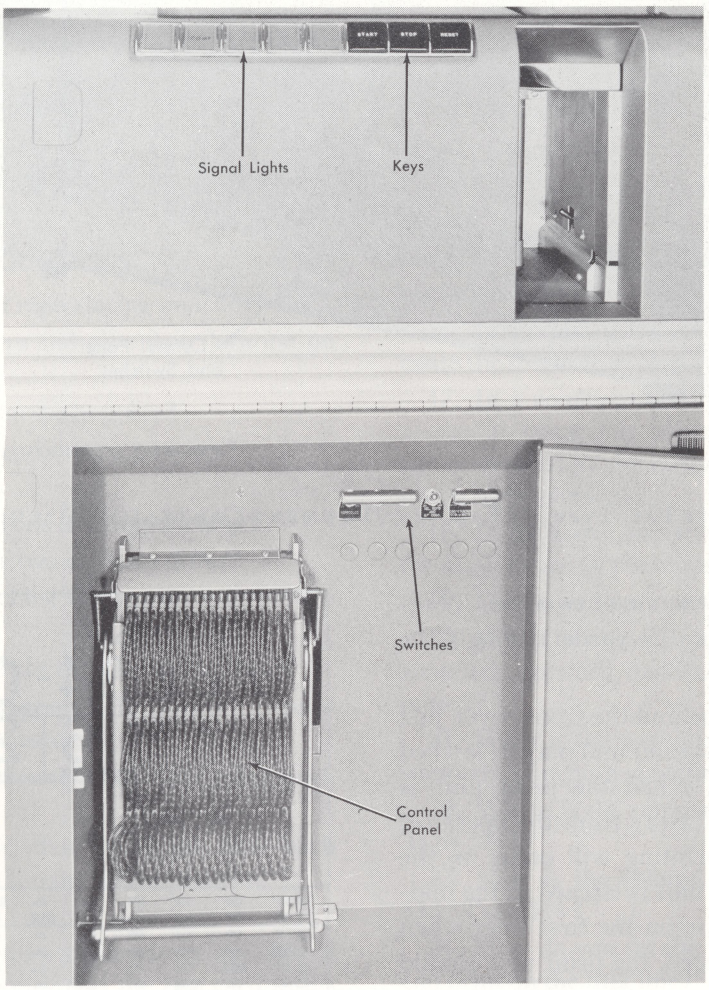


FIGURE 105. CONTROL PANEL AND SWITCHES

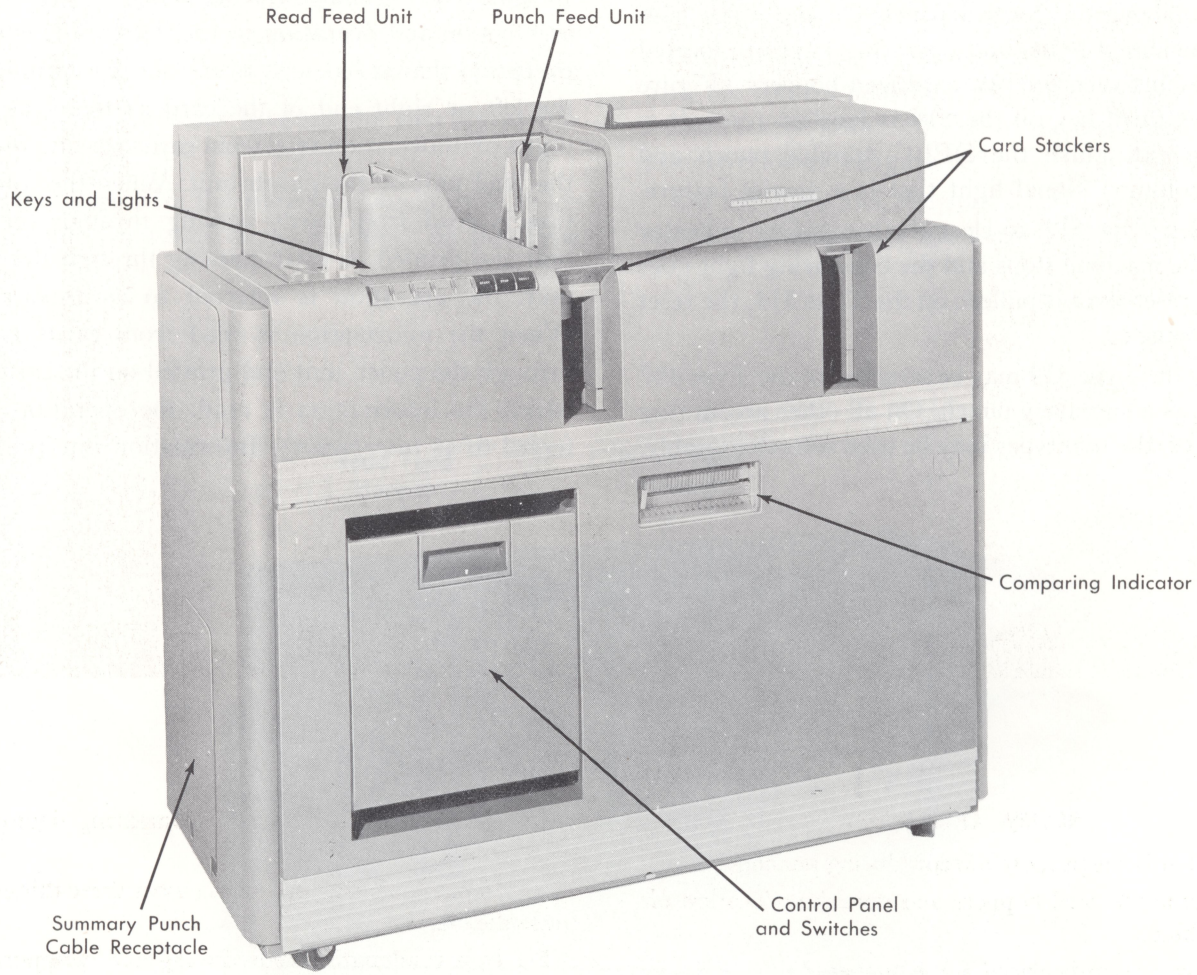


FIGURE 106. TYPE 519 ELECTRIC DOCUMENT-ORIGINATING MACHINE

transcribed may be printed on one of two lines (Figure 107) with one pass of the cards through the machines.

The print unit is located behind the front cover just to the left of the punch unit stacker and may be latched in one of three positions. When the print unit is latched in the notch farthest away from the operator, as shown in Figure 108, printing will occur on the second line. When the print unit is latched in the middle notch, printing will occur on the first line; when the printing feature is not used, the print unit should be latched in the notch nearest to the operator to prevent unnecessary wear on the ribbon and other moving parts.

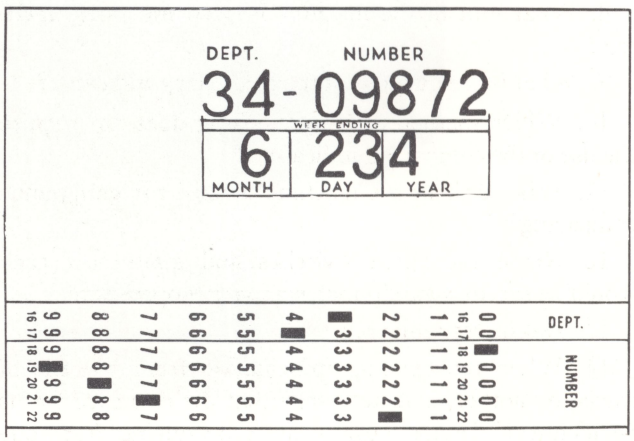


FIGURE 107. END PRINTING

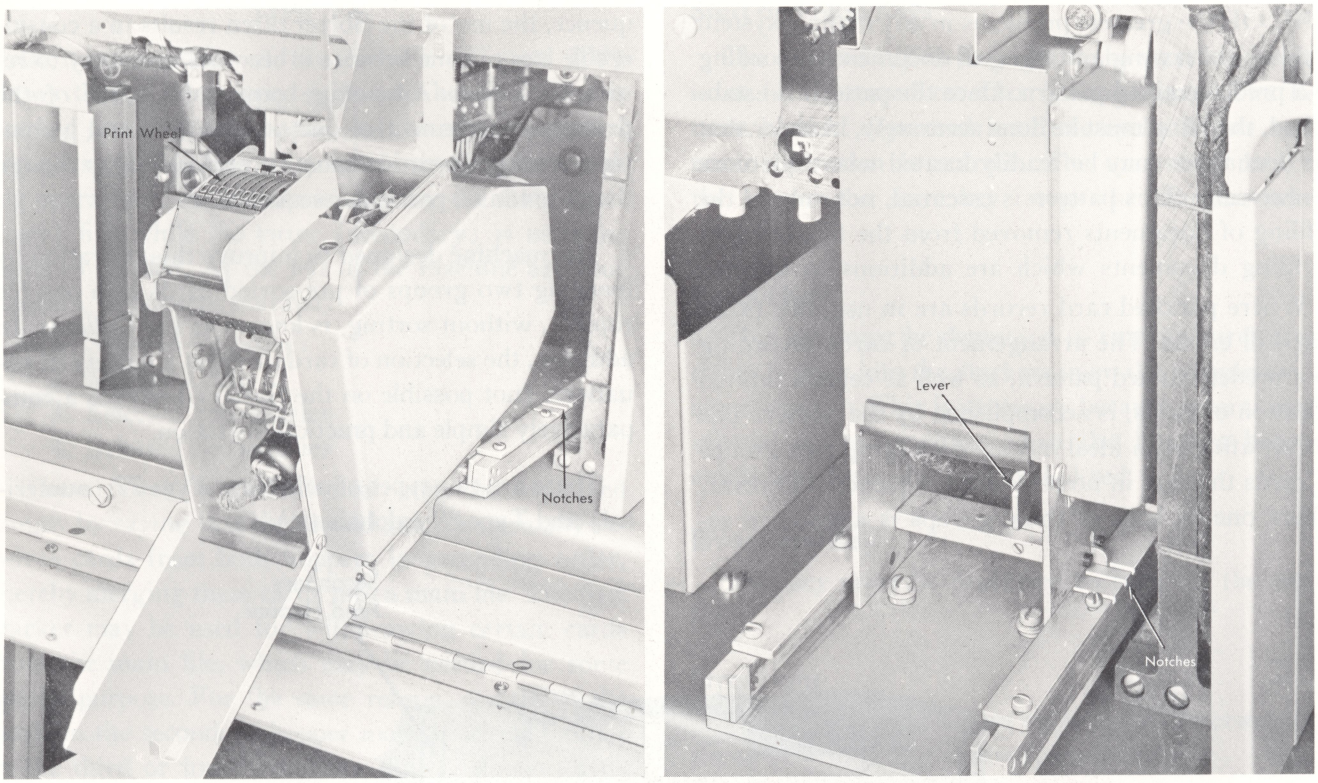


FIGURE 108. PRINTING UNIT

REVIEW QUESTIONS

1. What is the purpose of reproducing punches?
2. Name the card hoppers and give their location on the machine.
3. How are cards placed in the hoppers?
4. What is the speed of reproducing punches?
5. Define gangpunching.
6. What are the two methods of gangpunching?
7. In what manner do the two methods differ?
8. What unit of the machine is used for gangpunching?
9. What is the purpose of the comparing indicator?
10. Which method of gangpunching does not require the use of the comparing indicator?
11. What unit of the machine is used for gangpunch comparing?
12. Name the three switches and state how each would be set for a gangpunch comparing operation.
13. Define reproducing.
14. When reproducing information from one file of cards to another, is it necessary that the two card forms be identical? If not, how is the reproducing from one form to another varied?
15. Is it necessary to use the comparing device in a reproducing operation?
16. In a reproducing operation, what three things may cause the machine to stop?
17. In a combination reproducing and gangpunching operation, using only one master card, what information can be verified by the comparing unit and what information is sight-checked?
18. In the above operation, how may reproducing into the master card be prevented?
19. Define summary punching.
20. What machine produces the information to be summary punched and how is the information transmitted?
21. What is the position of the reproduce switch in a summary punching operation?
22. Where is the summary-punch cable located on the Type 514?
23. How is the column indicator reset on the Type 513? Type 514?
24. How do you set the print unit on the Type 519 to end print on the first line?
25. How is the print unit latched when the printing feature is not desired?

IBM COLLATORS

ONE OF the greatest problems in any manual system is the withdrawing and filing of documents according to a predetermined pattern. Once the pattern is established, the filing must be done accurately, in order that the documents may be readily located when reference is necessary. This pattern is essential, not only in the refiling of documents removed from the file, but also in filing documents which are additions to the file.

Where punched card records are in use, this problem still exists. The arrangement of cards according to a predetermined pattern, as well as certain limited selection of cards, is accomplished by the Sorter. The Sorter affords an ideal means of merging two groups of cards that are in no particular sequence. However, where one or both of these groups is already in sequence, the use of the Sorter often results in a considerable loss of time because it becomes necessary to resort both files. Advantage cannot be taken of the present arrangement of one or both files and a complete sorting operation must be performed, as though they were in no particular sequence.

The machine designed to improve this operation by merging two groups of pre-sorted cards into one file rapidly, without sorting, is known as the *Collator*. In addition, the selection of cards to meet a variety of situations (not possible on the Sorter) becomes a comparatively simple and practical operation.

There are two types of collators: Type 77 (numerical) and Type 89 (alphabetic).

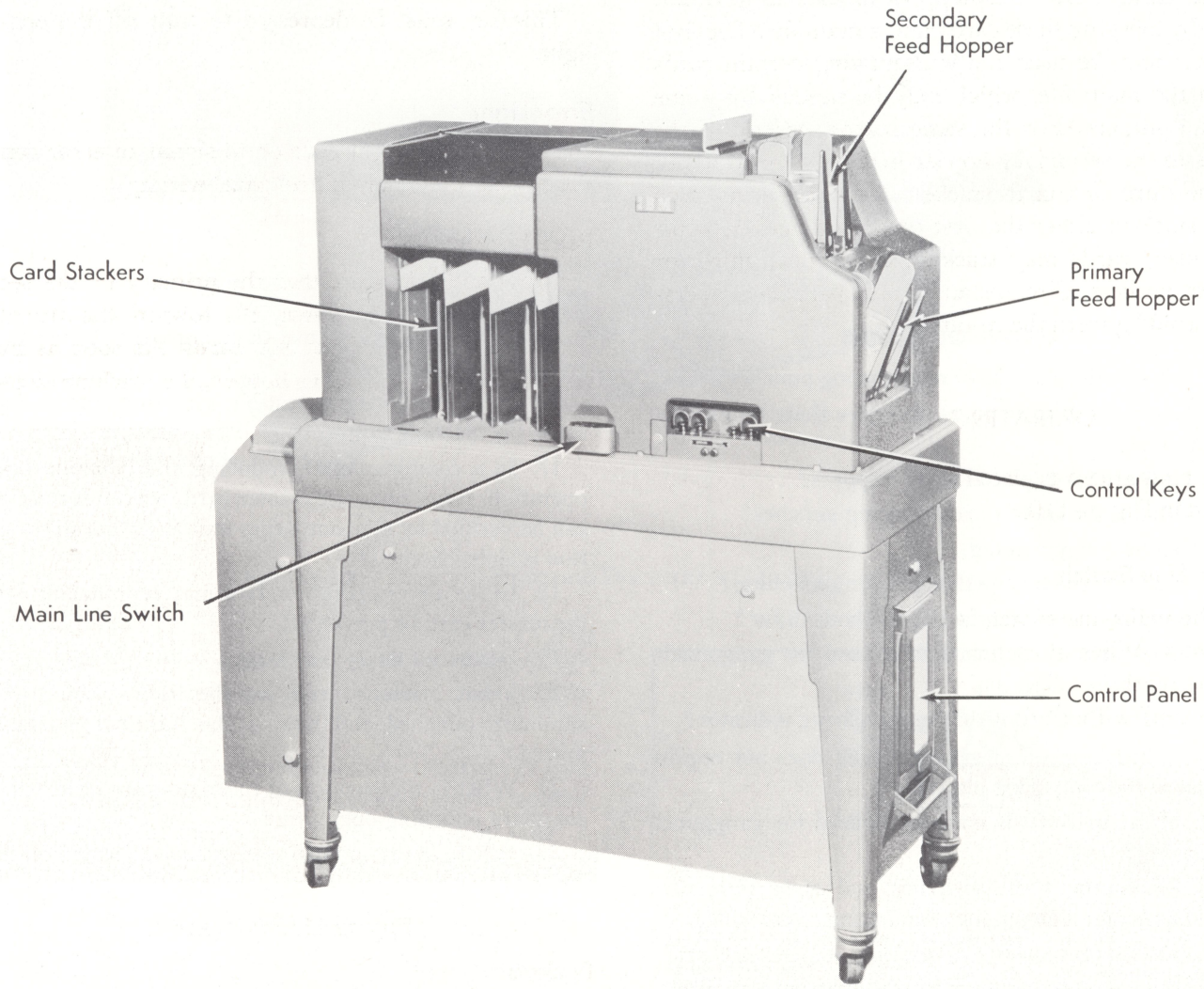


FIGURE 109. TYPE 77 COLLATOR

TYPE 77

THE ILLUSTRATION of the collator (Figure 109) shows that it is equipped with two hoppers. One is marked *primary feed hopper,* and the other is marked *secondary feed hopper.* In normal interfiling or merging operations, the former is used for the main (primary) file, while the latter (secondary) is used for cards to be filed. At the left of the machine are four stackers, or pockets, marked:

1. Selected Primaries
2. Merged Cards
3. Selected Secondaries
4. Selected Secondaries

These terms, while technical, may be explained simply by saying that the second stacker normally receives cards from both hoppers in ascending order, thereby merging these cards into a main file. The first stacker may be used for withdrawing certain cards from the main file, which may be needed for some special purpose. For the same reason, certain of the cards in the secondary hopper may be selected either in the third or fourth stacker. Thus, primary cards may stack in either the first or second pocket, while secondary cards may stack in the second, third, or fourth pockets. Circumstances of a particular operation would govern the results.

OPERATING FEATURES

THE OPERATING FEATURES described below are illustrated in Figure 110.

Main-Line Switch

The main-line switch is located to the right of the stackers. When it is turned on, current is supplied to the machine. The main-line switch should not be turned off without first depressing the stop key.

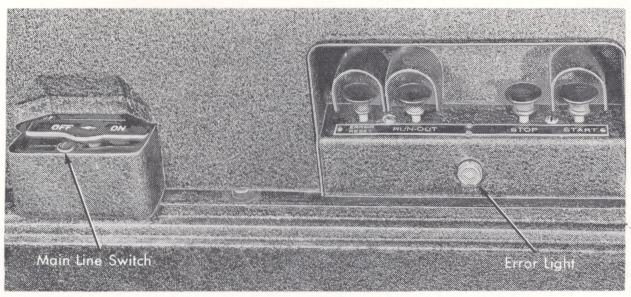


FIGURE 110. OPERATING KEYS

Start and Stop Keys

The covered key at the right is the start key, which must be depressed to start feeding cards. The key must be held depressed for three cycles before automatic operation is started. The uncovered key, to the left of the start key, stops the machine when depressed.

Runout Key

This key must be depressed to run out cards from either hopper into the stackers upon the completion of any operation. This is necessary because several cards remain in the machine when the hoppers become empty and the operation is completed.

Error Reset Key

This key must be depressed to turn off the error light.

Error Light

The red error light goes on to signal an error condition determined by control panel wiring.

Feed Hoppers

Cards are fed into either the primary or the secondary hopper, face down, 9's toward the throat. Each hopper holds about 800 cards. As soon as the last card is fed from either hopper, the machine stops.

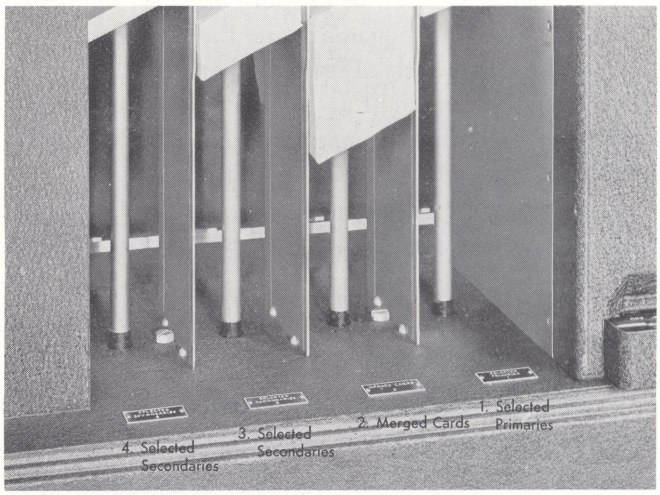


FIGURE 111. POCKETS

Pockets

Each of the four pockets (Figure 111) holds about 1,000 cards. When any of the pockets becomes filled, the machine stops.

Control Panel

This is the "brain" of the machine and must be inserted in the proper receptacle at the right end. It is impossible to feed cards from either hopper unless the control panel is in the machine.

OPERATING PRINCIPLES

A COLLATING OPERATION, whether manual or automatic, is accomplished by means of comparing control fields on two different cards. If the two sets of cards to be merged are in sequence, a card in the first file can be compared with a card in the second file. The comparison will have one of three results (Figure 112).

1. The card in the first file is low (A and C).
2. The card in the second file is low (B).
3. The cards in both files are equal (D).

Low cards are merged in front of the file. For equals, the card in the first file is merged in front of the card in the second file. This arranges the cards in ascending numerical order.

Through the use of the collator, this merging operation becomes fully automatic. The two sets of cards are placed in the machine and the control numbers are read from the punched holes and are compared. The result of the comparison is used in turn to direct the machine to file the cards together in proper sequence.

The schematic diagram (Figure 113) is, in effect, a cutaway view of the primary and the secondary feed units and the three sets of brushes that read the cards. The lower line drawn at an angle represents the primary feed unit and the upper line the secondary feed unit. The four pockets are shown at the left.

The Type 77 Collator operates at a speed ranging between 240 and 480 cards a minute, depending upon the operation performed.

MACHINE FUNCTIONS

1. *Sequence Checking.* This term is self-explanatory and is used to describe the operation whereby the present sequence of a file of cards is automatically checked. This operation may be performed as an independent function or in combination with a merging or matching operation. In normal practice, any file to be checked for sequence must be run through the primary feed hopper, and the cards will enter the second stacker (pocket 2).

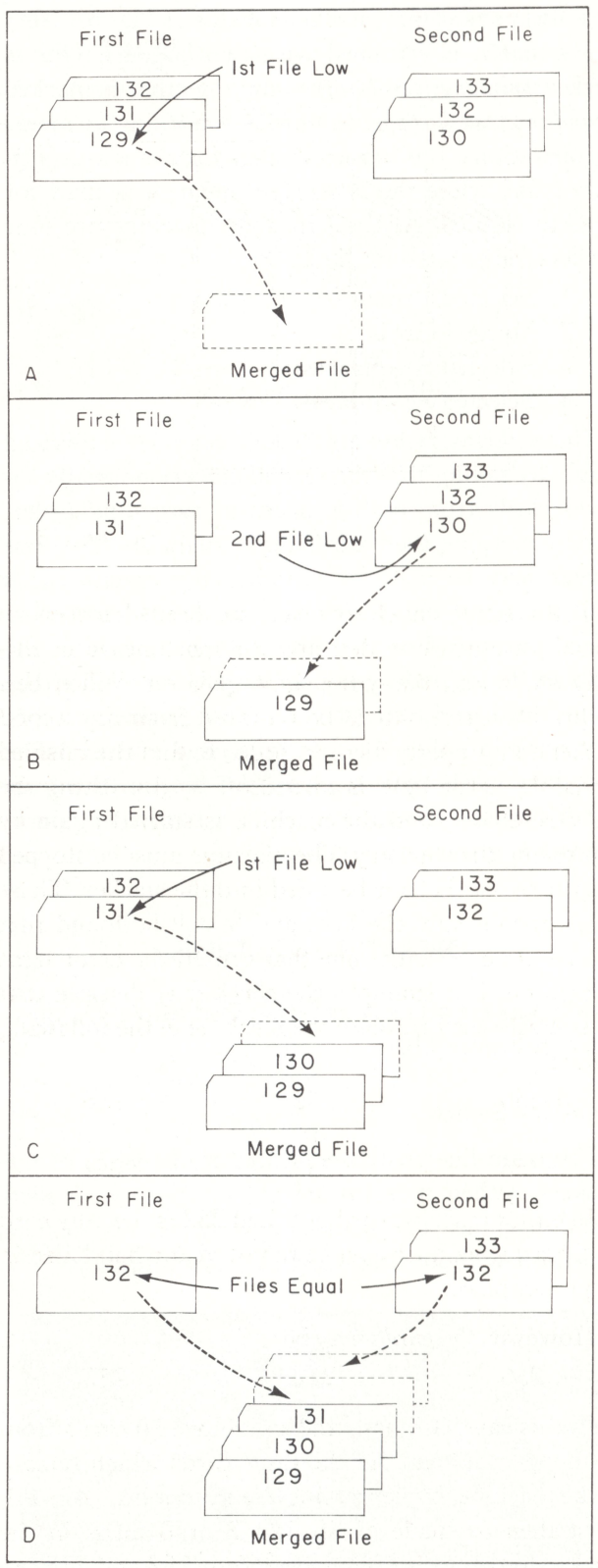


FIGURE 112. MANUAL MERGING

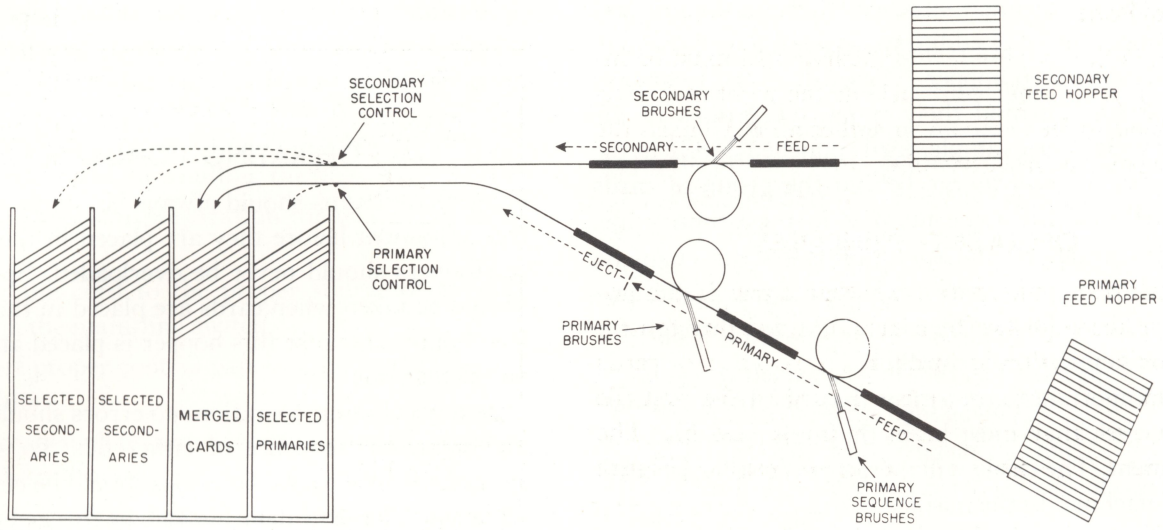


FIGURE 113. SCHEMATIC DIAGRAM

The control panel is wired so that whenever an error in sequence is detected the machine automatically stops and the error light goes on. When this occurs, the cards should be removed from the second pocket and properly filed. In order to find the misfiled cards, the error light is turned off by depressing the error-reset key, and the machine is started again by depressing the start key. The machine must be stopped after three cards have been fed into the stacker. These cards are visually checked, and it will be found that the second card is the one that caused the error light to turn on. For example, the check may disclose that these cards went through the machine in the following order:

256	252	256
	or	
256	252	257

In either case, the card punched 252 is the only card out of sequence and must be removed and hand filed in its proper place.

However, the cards may be:

256	252	253

In this case, it is essential to remove all cards from the hopper and run out the three cards which remain in the machine, by depressing the runout key. A check must then be made of the last 7 or 8 cards in the stacker to determine whether 256 or 252 and 253 are out of order. All cards out of order should be removed and manually filed later. The last card in sequence should then be checked against the first few cards in the hopper. If more cards are out of sequence, they should be removed before the operation is resumed.

2. *Primary Card Selection.* This term is used to describe the selection of any card or cards from the file in the primary hopper, depending upon the conditions wired in the control panel. These conditions may vary considerably. For example, it may be desired to withdraw or select the first of each group of cards punched with the same number, the last of each group of cards punched with the same number, or single cards not a part of any group.

Other types of primary card selection involve the selection of all cards with a given number punched in a master card or cards punched with numbers between an upper and lower limit; i.e., 1240 or 3599.

Other types of primary card selection are possible, but the foregoing ones are mentioned merely to indicate the flexibility of the machine.

From an operating standpoint, however, it is sufficient to know that, in any of these selection operations, cards to remain in the file normally will drop into the second pocket, while cards to be selected (regardless of the problem) will drop into the first pocket.

In any of these operations, cards selected may be automatically replaced by indicator or signal cards fed from the secondary feed hopper.

3. *Merging or Interfiling.* A merging operation always involves two groups of cards—a main (primary) file and an additional (secondary) file.

Ordinarily, the main file feeds through the primary feed hopper, and the additions to the file feed through the secondary feed hopper. The cards in the secondary file will stack behind their respective groups in the primary file. For example, cards punched 34871 in the secondary file will merge behind the group of cards punched with the same number in the primary file.

If the reverse of this operation is desired (namely, that the secondary cards be filed in front of the primary cards), the two files should be fed through the opposite hoppers of the machine.

It is important to remember that, before two groups are merged, they must be in the same numerical arrangement. The cards will merge in the second pocket of the machine. In the majority of cases, the numerical arrangement is ascending order. In rare cases, the cards are in descending order.

This merging operation may be performed in combination with *Primary Card Selection* and *Sequence Checking* previously described.

4. *Matching.* Matching differs from merging in that the two files of cards are kept in separate groups, in the same order that they were placed in the hoppers. The operation merely proves that for each card or group of cards in the primary file there are corresponding cards or groups of cards in the secondary file and vice versa. In a matching operation, the primary cards will stack in the second pocket while the secondary cards will stack in the third pocket.

A variation of this operation may also include primary card selection and secondary card selection, in which event cards may be spread throughout all four pockets.

5. *Matching or Merging with Selection.* This operation combines merging or matching with either primary card selection, secondary card selection, or both. For example, the main objective may be that of merging; but, when special conditions arise in the files, it is desired to select either primaries or secondaries. Some of these special conditions may be the selection of primary cards for which there are no corresponding secondaries, or the selection of secondary cards for which there are no corresponding primaries. These are referred to as *unmatched primaries* and *unmatched secondaries.* The following example may assist in the understanding of these terms:

SECONDARY FILE 1-1-(2)-3-3-3-5-5-etc.

PRIMARY FILE 1-3-3-(4-4-4-4)-5-etc.

The card punched 2 in the secondary file is an unmatched secondary. The four cards punched 4 in the primary file are unmatched primaries.

OPERATING POINTERS

GROUPS OF CARDS should always be joggled into perfect alignment before they are placed in the hoppers.

Hoppers should never be overloaded. Special care should be taken when cards are placed in the primary feed hopper, because this hopper is placed at an angle on the machine.

In any collating operation, no errors should exist in the numerical sequence of either file. To safeguard against misfiled cards, both files should be checked for sequence. The secondary file may be checked as a separate operation. The primary file is checked simultaneously with the merging operation.

Before processing an operation where sequence checking is required, make a test by purposely inserting several blank cards in the first 400 or 500 cards to be checked. The blank cards will break the continuity of any series of numbers, and the machine should stop when the blank cards feed through. If the machine does not stop when these blank cards pass through, an error has been made in wiring the control panel. When this occurs, ask your supervisor to correct the control panel.

When the operation includes merging and selection, be sure that you know what to do with each file. This applies not only in the handling of the files previous to the operation but also in the handling of the files after the operation has been completed.

To save time in a merging operation, check the first card of each file. For example, if the first card in the primary file is punched 128 and the first card in the secondary file is punched 988, the primary file cards from 128 to 987 need not go through the machine. Merging may start with group 987 in the primary file. If the first card in the secondary file is a considerably lower number than the first card in the primary file, none of the secondary cards which are punched with numbers lower than the first card in the primary file needs to go through the machine.

Never turn off the main-line switch while cards are going through the machine. Use the stop key.

In case of a jam in this machine, depress the stop key immediately and call your supervisor. The damaged cards will have to be duplicated, or repunched, and hand filed.

HOW TO OPERATE THE COLLATOR

1. Make sure you understand the operation to be performed. If in doubt, ask your supervisor to explain.

2. Arrange the cards to be processed so that no confusion will result in handling the files.

3. Make sufficient preparation for temporary storage space.

4. Plug the cord to the proper source of current and turn on the main-line switch.

5. Insert proper control panel in the receptacle and clamp tightly.

6. Make complete test according to the requirements of the operation.

7. Joggle cards and place them in the proper hopper, face down, 9's first.

8. Press the start key.

9. Watch the hoppers and stackers in order to load and empty the machine as required, without loss of machine time.

10. Joggle cards removed from the stackers and file them according to instructions received from the supervisor.

11. When either hopper becomes empty and the operation is completed, remove the cards from the other hopper, because it is not necessary to run them through the machine. Depress the runout key until the five cards (2 secondaries and 3 primaries) are run into the stacker. Check the sequence of the last five cards and manually file them in their proper places, if necessary.

12. Turn the main-line switch off at the end of the operation.

13. Remove the control panel and store it in its proper place.

REVIEW QUESTIONS

1. What is the purpose of the collator?

2. How are cards fed into the machine?

3. In normal interfiling or merging, what is the purpose of the primary feed? Secondary feed?

4. In what pockets may primary cards stack? Secondary cards?

5. How long must the start key be held depressed before automatic operation begins?

6. What is the purpose of the runout key?

7. What is the purpose of the error reset key?

8. When does the error light go on?

9. Will cards feed without a control panel?

10. What is necessary before two groups of cards may be merged accurately?

11. Which feed is used for sequence checking?

12. How fast will the collator operate?

13. How many cards should be fed into the stacker after an error is detected, and which one is the error card?

14. If more than one card is in error, what must be done?

15. In a merging operation, which cards of the same control number merge in front, Primaries or Secondaries?

16. In a matching operation, into what pocket will primary cards stack? Into what pocket will secondary card stack?

17. In matching or merging with selection, what pocket will receive unmatched primaries?

18. In the same operation, what pockets will receive unmatched secondaries?

19. How may sequence checking be tested?

20. When either hopper becomes empty and the operation is complete, what must be done before the main-line switch is turned off?

TYPE 89

THE OPERATION of the Alphabetic Collator, Type 89, is similar to that described for the Type 77. The main difference between the two machines is that the Type 89 can read letters as well as numbers. Alphabetic as well as numerical fields in a card can be sequence checked, selected, merged, matched, matched or merged with selection. The Type 77 Collator performs these functions only for numerical fields.

There is very little difference in appearance between the two machines. An additional light, "Running Indicator Light" (positioned to the right of the error light) turns on whenever the main-line switch is on. This light may also be found on later models of the Type 77.

It must be remembered that when performing such operations as those described for locating error cards, when the error light turns on, letters as well as numbers can be out of order.

IBM CALCULATING PUNCHES

IN MAINTAINING individual records, it is often necessary to perform many computations, such as addition, subtraction, multiplication, and division on each record. The accuracy of final reports depends upon the accuracy of these computations.

The manual method, with pencil and paper, is probably the most commonly used method of obtaining the result of a combination of figures. Other methods involve the use of key-driven machines, manually operated, such as adding and calculating machines.

In the early stages of punched card accounting, when it was necessary to record computations in individual cards, these computations had to be figured and posted to the source document before punching, in order to have a complete punched card record for the preparation of reports. This was always a time-consuming operation.

There have been several IBM calculating punches developed, which are capable of automatically performing computations involving adding, subtracting, multiplying, and dividing, and punching the results into cards. Only one of these machines will be covered in this manual—the Type 602A Calculating Punch.

TYPE 602A CALCULATING PUNCH

THE CALCULATING PUNCH (Figure 114) reads factors punched in IBM cards, performs calculations using these factors, and punches the results either in the card from which the factors are read, or in designated cards that follow. The calculations consist of combinations of the basic operations of adding, subtracting, multiplying, and dividing. The machine

FIGURE 114. TYPE 602A CALCULATING PUNCH

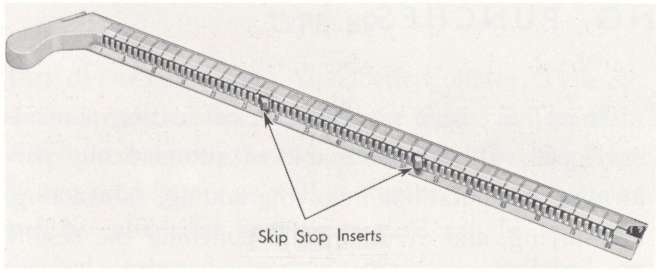


FIGURE 115. ADJUSTABLE SKIP BAR

operates at a speed of 200 cycles per minute. The number of cycles required for the calculation of a card depends upon the size of the factors and the type of problem.

OPERATING FEATURES

Control Panel

The control panel, wired for the specific problem, is placed in the rack at the lower right of the machine. Wires must not be permitted to fall between the panel and the rack, or to interfere with the operating mechanism. When the front cover is closed, the control panel is in position to control the machine.

Adjustable Skip Bar

The adjustable skip bar (Figure 115) contains 80 positions, one for each column of the card, in which a small insert is placed for the first column of each field to be punched after a skip. The small notch under the triangular head of the insert faces toward the back of the bar. After the skip bar is prepared, it is inserted in the machine immediately back of the punch bed, located under the upper front cover to the right of the stacker. The skip bar is most easily removed by pushing it up and slightly to the right, with the thumb and forefinger. The rack holding the skip bar should be all the way to the left before the skip bar is removed.

Single skip stop inserts cannot be placed in adjacent positions; use a special DOUBLE SKIP STOP insert for this purpose.

For operations requiring no punching, a skip bar without inserts must be used.

Feed Hopper

Cards are placed in the feed hopper face down, with the 9 edge toward the throat. When the machine is placed in operation, the cards feed through the machine in the manner shown in Figure 116.

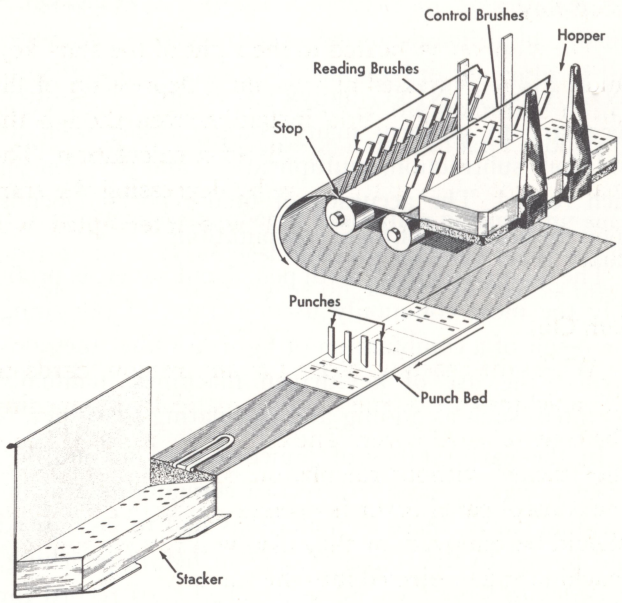


FIGURE 116. PATH OF THE CARD THROUGH THE MACHINE

Main-Line Switch and Pilot Light

The main-line switch is located on the right end of the machine. This switch must be turned on to supply power to the machine. When it is turned on, an unlabeled signal light indicates that the machine is ready to operate. This light, located to the left of the feed hopper, is off while the machine is operating.

Start Key

Depressing this key causes the machine to start feeding cards. The first card enters the machine (Figure 116) and passes the control brushes. At this station, control X's or digits may be read, after which the card stops until the machine performs a complete set of calculating cycles to clear counters in preparation for calculating the first card. The first card then moves past the reading brushes where the factors are read for making the calculation. The card continues to feed in a semicircular path into the punch bed, where it is skipped into position for punching the first column of the first result field. After calculation of the result is completed, a new card feeds past the reading brushes and the machine begins calculation for the new card while the previous card is being punched. As soon as punching of each card is completed, it is ejected into the stacker face down.

Stop Key

The stop key is located to the right of the start key, and may be depressed at any time. Depression of the stop key will stop action instantly, even though the machine may be in the middle of a calculation. The machine may be started again by depressing the start key, and the calculation that was interrupted will continue.

Run Out

When the machine stops for any reason, cards in the machine can be run out automatically by opening the control panel cover. The cards will be ejected into the stacker without calculation or punching. Before the control panel cover is opened, cards in the hopper should be removed, or they also will run through the machine and be ejected into the stacker.

Signal Lights

The purpose of the unlabeled light is described with the main-line switch. The comparing light is used principally to signal an error detected during a checking operation. It may also signal a burned-out fuse or an error in control panel wiring.

MACHINE FUNCTIONS

THE CALCULATING PUNCH may be used to perform the following functions as set up by the control panel:

Crossfooting. Two or more factors in the same card may be added or subtracted and the result can be punched or used as a factor for further calculations during the same passage of the cards through the machine. Crossfooting two factors is described as $A + B = T$ or $A - B = \pm T$.

Example: Regular Hours + Overtime Hours = Total Hours

Item Amount — Cost Amount = ±Profit or Loss

Multiplication. One factor may be multiplied by another factor to produce a single product. Several factors can be multiplied simultaneously by a single factor to produce several products. Several individual multiplications may be performed in a single run. Simple multiplication is expressed as $A \times B = P$.

Example: Piecework Rate × Number of Pieces = Piecework Earnings.

Division. When this feature is available, one factor can be divided by another factor to produce a single quotient. Several individual division operations can be performed in a single run. Simple division is expressed as $A \div B = Q$.

Example: Regular Earnings ÷ Actual Hours = Average Rate.

Combination Operations. Crossfooting, multiplication, and division can be performed successively in any sequence during a single run. Separate results can be punched for each type of calculation, or each result can be used as a factor for following calculations. One type of combination operation is expressed as $A \times B = P$; $P \div C = R$.

Group Calculation. This method allows a common factor to be set up in the machine. This factor is usually set up from an X-punched master card sorted in front of a group of detail cards. Factors in the detail cards and factors in the master card are used in the manner determined by the control panel wiring.

Example: A master card punched with the hourly rate precedes the detail cards that contain the number of hours. The hourly rate is set up in the machine; and as the detail cards pass through the machine, they are multiplied by the hourly rate, and the result, gross pay, is punched into each detail card. As each master card passes through the machine, the X-punch allows the previous multiplier to be cleared, and a new multiplier to be introduced.

Summary Punching. Factors may be accumulated from several cards, and the sum can be punched or used as a factor for a calculation for the last card of the group.

OPERATING POINTERS

Watch the stacker and remove cards at frequent intervals. Never allow the stacker to become too full.

The skip bar is most easily removed by pushing it up and slightly to the right. The rack holding the skip bar should be all the way to the left before the skip bar is removed.

If the skip inserts are not inserted in the proper columns, the machine will not punch the answers properly. If the skip insert is placed to the left of the proper column, the machine will stop and the card will fail to punch. Remove the cards from the hopper

and open the control panel to cause the cards in the feed to enter the stacker. If the skip insert is erroneously placed to the right of its correct position, only part of the result will be punched, with no immediate evidence that the answer is not correct.

Failure to place any inserts in the skip bar will cause the machine to skip the card immediately to column 80 and remain there until the control panel is opened. This occurs only when provision has been made for punching results in the card.

The amounts standing in any storage unit are visible when the top cover is raised.

If a fuse should blow, a small plunger drops from the lower end, making it readily detectable. This plunger prevents further operation of the machine until the fuse is replaced.

The main-line switch should never be turned off while the machine is in operation. Stop the machine by depressing the stop key before turning the main-line switch off.

If, after the pilot light glows, cards do not feed at all when the start key is depressed, be sure that all covers are closed. Open doors or covers may prevent the machine from starting.

If, when the start key is depressed, cards feed into the machine but do not feed through and enter the stacker, it is probable that a skip insert has been placed in the wrong column of the skip bar.

If, when the first cards are checked, it is found that only part of the answer has been punched, the skip bar insert has been placed too far to the right to punch the high-order columns of the field. There is no other immediate indication that the card is not punched correctly. This is one reason why the manual check of the first cards is important.

In a checking operation in which the machine stops for errors, the error card may be either the last card in the stacker or the card in the rack, depending on how the control panel is wired. If the card is in the stacker, it will have been punched and will have to be corrected. If the card is in the rack, the erroneous calculation will not have been punched and may be rerun. To do this, the cards in the feed hopper are removed and the reset key is depressed. The control panel rack is opened to allow the cards in the machine to be run out. Then the group of cards from the error card on are placed in the hopper and the machine is restarted by pressing the start key.

HOW TO OPERATE THE TYPE 602A CALCULATING PUNCH

1. Make sure that you understand the operation to be performed. If in doubt, ask the supervisor to explain fully.

2. See that the cord is plugged into the proper source of power. The main-line switch on the machine should be turned off when the machine is being plugged in.

3. Insert the control panel in the control panel rack and close the cover.

4. Lower the front cover by depressing the latches on both ends, and check the adjustable skip bar to see that the inserts are in the proper columns. If the rack is not all the way to the left, close front cover, turn on the main-line switch, and depress the start key. Insert the skip bar in its holder in the machine.

5. Turn on the main-line switch. The pilot light should glow, indicating that the machine is ready to operate.

6. Cards should be joggled into perfect alignment and placed in the feed hopper face down, with the 9 edge toward the throat. Best feeding results are obtained when the feed hopper is no more than three-fourths full. Always place the card weight on top of the cards.

7. Depress the start key. Cards should feed through the machine, be calculated (or checked) and punched. When two cards have entered the stacker, depress the stop key. Check the computations on these two cards manually. If correct, place them back in the stacker in proper sequence, face down, 9 edge toward the front of the machine and press the start key to resume operation. If cards do not check, call the supervisor.

8. At frequent intervals, remove the cards from the stacker, joggle, and file according to instructions.

9. At the completion of a checking operation in which 12's are punched for correct cards and 11's for incorrect cards, needle the proper column for 12's. Remove and correct any cards punched with an 11.

10. When the operation is completed, turn off the main-line switch.

REVIEW QUESTIONS

1. What is the purpose of the calculating punch?

2. When the results of calculations are obtained, how are they recorded?

3. When a card reaches the card bed but fails to punch, skip, or eject, what is most likely the cause?

4. The machine is wired to multiply two 2-position numbers. If the multiplier is 12 and the multiplicand is 12, the machine punches 44. What is most likely the cause?

5. The first card to enter the machine skips immediately to column 80 without punching any answers. What is most likely the cause?

6. What happens when the control panel rack is opened and there are cards in the machine?

7. When the comparing light turns on, what happens, and how is it turned off?

8. Why must all covers and doors be closed before an operation is begun?

9. How may a blown fuse be identified?

10. The machine has stopped and signals an error condition. The control panel is wired so that the error card is the top card in the stacker. What must the operator do now?

Form 22-8485-3